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Volume 19 December 1950 Number 12

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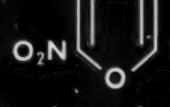

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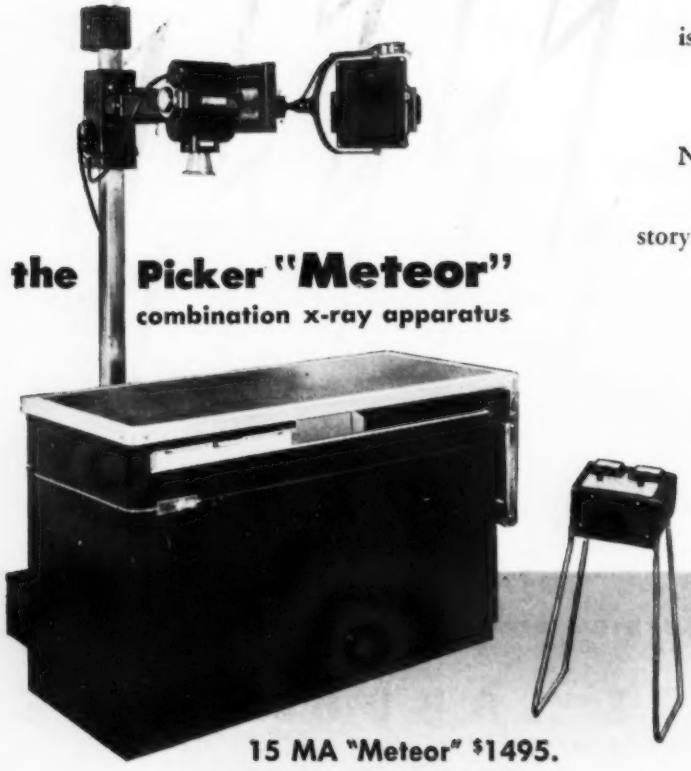

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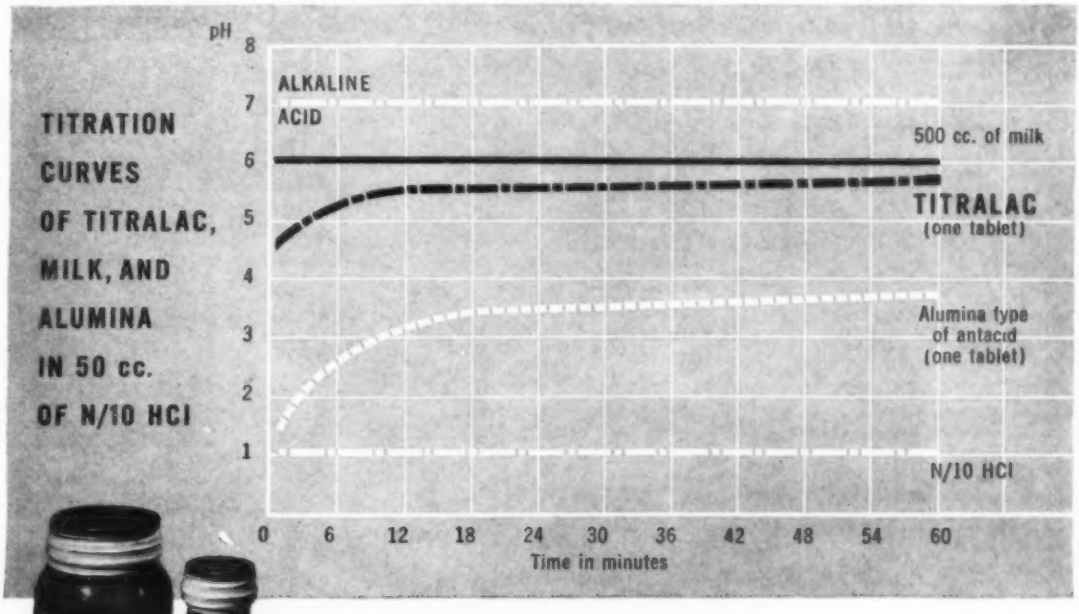

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1. Rossett, N. E., and Flexner, J.: Ann. Int. Med. 18: 193 (1944). 2. Freezer, C. R. E.; Gibson, C. S., and Matthews, E.: Guy's Hosp. Reports 78: 191 (1928). 3. Aaron, A. H.; Lipp, W. F., and Milch, E.: J. A. M. A. 139: 514 (Feb. 19) 1949. 4. Kirsner, J. B., and Palmer, W. L.: Illinois M. J. 94: 357 (Dec.) 1948. 5. Kimball, S.: in Practice of Medicine (Tice). Hagerstown, Md., W. F. Prior Company, Inc., 1948; p. 210. 6. Special Article: M. Times 76: 10 (Jan.) 1948.

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ROYD R. SAYERS, formerly Medical Director in the U.S. Public Health Service and perhaps the most highly qualified physician in the United States in industrial health, was appointed on September 20 to a new part-time post in the Health Department which was established by the Board of Estimates to strengthen the city's control of the occupational diseases. DR. SAYERS comes to Baltimore after being on the U.S. Public Health Service staff since 1913. From 1940 to 1947 he was assigned to serve as Director of the Bureau of Mines.

—*Baltimore Health News*, September-October, 1950.

THE TENTH International Congress on Industrial Medicine will be held in Lisbon, Portugal, September 9-15, 1951.

ROBERT W. SATTERFIELD, 24, of Washington, D.C., has been awarded the James S. Kemper Foundation graduate fellowship in industrial hygiene engineering at Harvard University's School of Public Health.

T. LYLE HAZLETT, M.D., director of the department of industrial hygiene in the School of Medicine, has been named a member of a final, non-court, state agency of appeal on medical issues involved in occupational disease disputes. The agency is empowered to examine applicants for occupational disease benefits to determine the exact state of their health, for the state workmen's compensation board.

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the current year will be eligible. The paper must present original laboratory or clinical ideas or research data pertaining to industrial medical or surgical subjects. All papers will be judged on originality, prospective or proved value of application in practice, and clarity of presentation. No paper shall have been previously published or presented at a meeting.

MAJOR JOHN E. BOYSEN has been named Deputy Air Surgeon to BRIGADIER GENERAL OTIS B. SCHREUDER at Air Materiel Command Headquarters. In addition to his duties as Deputy Air Surgeon AMC, he will be professionally engaged in activities in the field of preventive and industrial medicine. During the past three years he has spent two years as a Fellow in Industrial Medicine at the Kettering Laboratory, University of Cincinnati Medical School, Cincinnati, six months at the University of Chicago and two months at Oak Ridge, Tennessee, the latter periods in studies covering the medical aspects of radiation hazards. MAJOR BOYSEN, a Flight Surgeon, graduated from the School of Aviation Medicine, Randolph Air Force Base, in 1946. He is a graduate of the School of Medicine, University of Minnesota, where he also accomplished his pre-medical training. After a year's internship at Hackensack Hospital, Hackensack, New Jersey, he was engaged in private practice in Minnesota until called to active duty in August, 1941. He was 22 months overseas in the European theater with Medical Unit servicing the USAAF. After his return to the United States in December, 1945, he served at AMC installations, and, from January to June, 1947, was Assistant Chief of Industrial Medicine, and Chief of Professional Services Section in the Office of the Air Surgeon, Headquarters, AMC. He attended a short course in Surgery of the Extremities, Harvard Medical School, and in Tropical Medicine and Hygiene at the RAF Institute of Pathology, Halton, Berkshire, England. He is a member of the American Medical Association and the AMERICAN INDUSTRIAL HYGIENE ASSOCIATION.

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Meeting at Indianapolis, Indiana, Thursday, November 9, 1950, jointly with the Indianapolis Medical Society. At the morning session, A. K. HARCOURT, M.D., made some "Case Presentations," and BURLEIGH MATTHEWS, M.D., talked on "Eye Medication and Instruments for the Dispensary." In the afternoon, JAMES D. PEIRCE, M.D., spoke on "Problems of Cardiovascular-Renal Disease in Industry;" LOUIS SPOLYAR, M.D., on "Recent Developments in Occupational Diseases in Indiana;" and "Medical Testimony" was discussed from a doctor's standpoint by E. S. JONES, M.D., and from a lawyer's standpoint by JAMES V. DONADIO. In the evening, FREMONT CHANDLER, M.D., talked on "Low Back Pain," and EDWARD C. HOLMBLAD, M.D., on "Opportunities in Industrial Medical Practice."

HARVARD University School of Public Health, Department of Industrial Hygiene, is offering a two-month course in Industrial Health, February 5 to March 31, 1951. The offerings include "Basic Problems in Industrial Hygiene," PROFESSOR PHILIP DRINKER, and associates; "Industrial Medicine," ROBERT B. O'CONNOR, M.D.; "Personnel Administration," PROFESSOR B. A. LINDBERG; "Human Problems of Adjustment in Industry," DR. ROSS A. MCFARLAND; and "Industrial Medical Clinics," ALBERT O. SEELER, M.D., and HARRIET L. HARDY, M.D.

AMERICAN ASSOCIATION OF INDUSTRIAL PHYSICIANS AND SURGEONS, April 23-27, 1951, Atlantic City.

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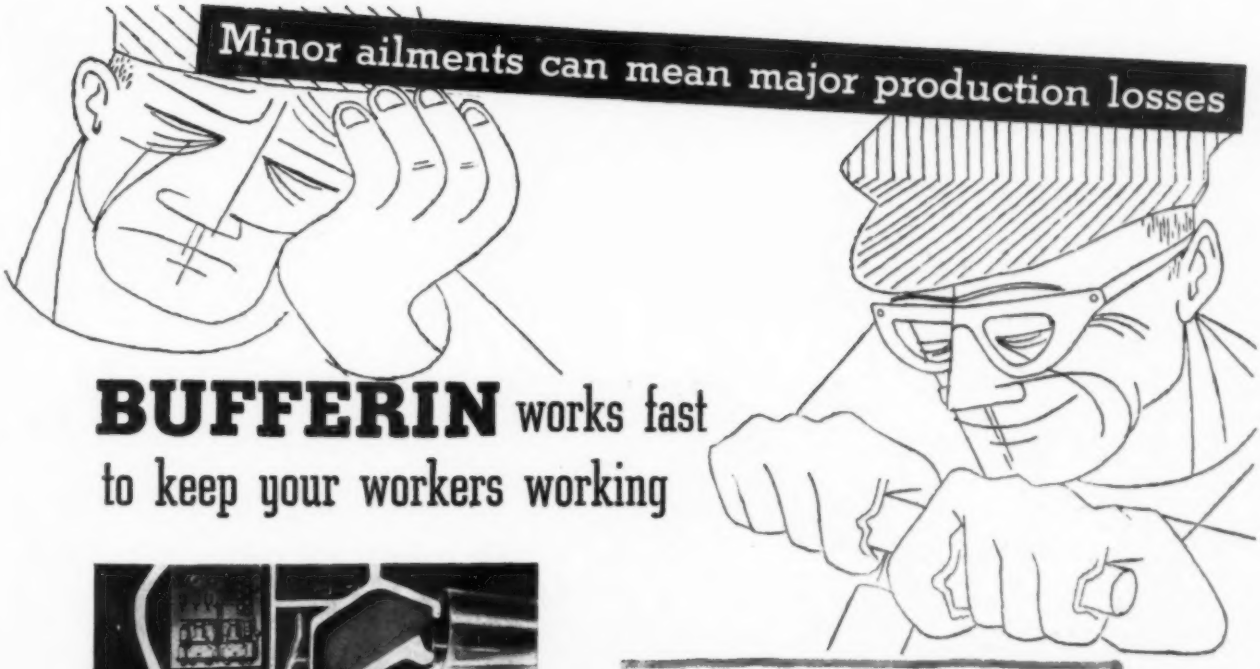

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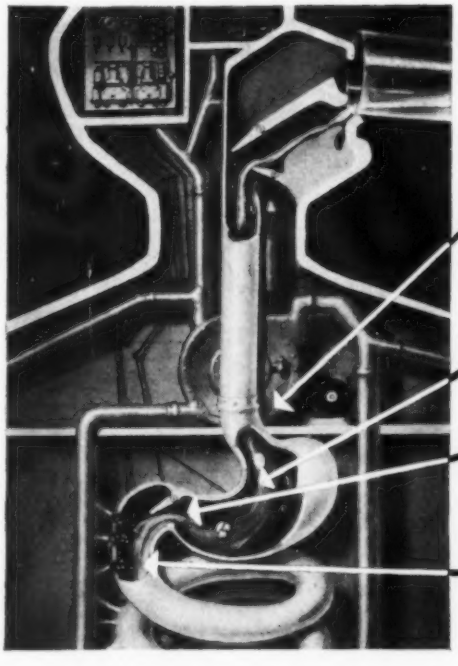

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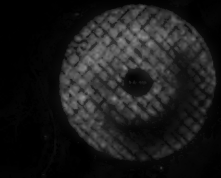

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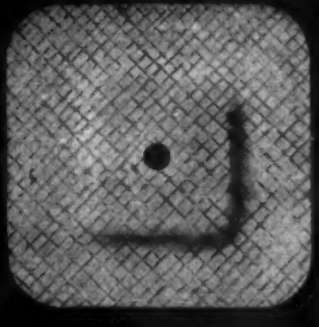

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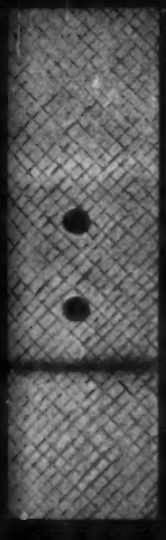

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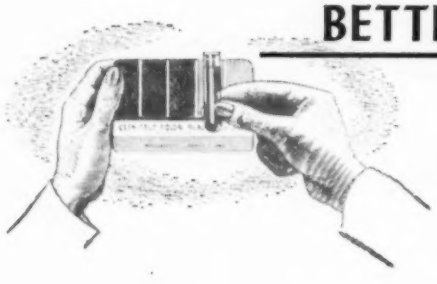

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Bibliography: (1) Wilkerson, H. L. C.: New York State J. Med. *49*:2945 (Dec. 15) 1949. (2) Sweeney, J. S.: Texas State J. Med. *45*:623 (Sept.) 1949.

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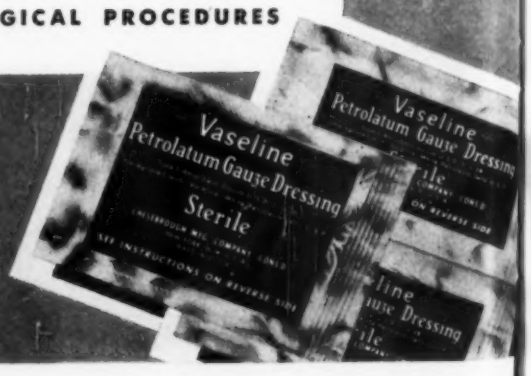

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1. Krasno, L. R., and Rhoads, P. S. (1949), The Inhalation of Penicillin Dust; Its Proper Role in the Management of Respiratory Infections, Amer. Prac., 11:649, July. 2. Krasno, L., Karp, M., and Rhoads, P. S. (1948), Inhalation of Dust Penicillin, Ann. Int. Med., 28:607, March. 3. Krasno, L., Karp, M., and Rhoads, P. S. (1948), The Inhalation of Penicillin Dust, J. Amer. Med. Assn., 138:344, October 2.

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INDUSTRIAL MEDICINE AND SURGERY
The Journal of Medicine in Industry
With which are consolidated "The Industrial Doctor" and "International Journal of Medicine and Surgery"
Volume 19 DECEMBER 1950 *Number 12*

Planning a Small Radioisotope Program

GEORGE W. REID,
Associate Professor of Sanitary Engineering, Georgia Institute of Technology, Atlanta, Georgia,
OSCAR M. BIZZELL,
Radiochemist, Isotopes Division, Atomic Energy Commission, Oak Ridge, Tennessee

MANY prospective radioisotope users are unfamiliar with the problems that must be faced when setting up an isotope program. Two of the major difficulties involve an unfamiliarity with nomenclature and with the prerequisites for the safe handling of radioactivity. Although isotopes are valuable tools in research, one should not attempt to use them until thorough training has been acquired.

A beginner needs considerable instruction and experience in order to cope successfully with specific problems involving the use of radioisotopes; indeed, the lack of such training has proved to be the largest single deterrent to wider isotope utilization. The purposes of this paper are to discuss some of the general prerequisites in planning a small radioisotope program; to furnish several sources of reliable information on the safe handling and use of radiomaterial; to cover the relative costs of the major items required in a radioisotope laboratory; and to outline the waste disposal problem and provide examples of some of the cooperative programs in this field.

Valuable information is obtainable from the Atomic Energy Commission's Isotopes Division, Oak Ridge, Tennessee, which is responsible for the allocation of all radioisotopes produced in, and distributed through, Commission facilities. The Advisory Field Service Branch of the Isotopes Division also offers consultations to those planning a radioisotope program. An analysis of the beginner's problems will often result in a considerable saving of time and money in the purchase of equipment and in the planning of the research program.

Available Literature

DURING the early planning stages of the program, elementary literature on isotope utilization should be acquired, particularly regarding the nomenclature used in the field of radioactivity.[1] Unclassified atomic energy publications such as Nuclear Science Abstracts and others are available,[2] many of which pertain to radioisotope applications. Other publications can be obtained from industrial laboratories that are manufacturing radiation-detecting instruments, preparing special isotope-labelled compounds, or offering consultation in isotope techniques. Books on atomic energy are appearing which present up-to-date treatment,[3] and many older texts have been revised to include as much as possible about the various aspects of this new field.

The degree of preliminary training required will depend upon the nature of the investigation to be made and upon the kind and quantity of radioisotopes employed (whether it be on the tracer or therapeutic level). A knowledge of the basic concepts pertaining to radioactivity is just as important to the beginner as a thorough knowledge of physiology is to the physician, or a knowledge of mathematics to the engineer. These requirements should not serve to discourage persons planning a radioisotope laboratory; instead they should be considered essential to performing satisfactory work.

Where to Go for Training

TO ALLEVIATE the shortage of trained personnel, the Atomic Energy Commission, in cooperation with various other organizations, has established several centers offering instructions in radioisotope handling and health-safety procedures. Several of these training programs, with a brief description of each, are mentioned below. After the basic training has been acquired, it may be advisable to become affiliated with a radioisotope laboratory actively engaged in specialized work if research in such a field is anticipated.

Since training in handling techniques as well as training in the theoretical aspects are a "must," it is well to review briefly what facilities exist and the conditions under which they are available. Civilian training can be obtained

Presented by GEORGE W. REID at the Twenty-fifth Annual Meeting, Texas Public Health Association, Galveston, February 20, 1950.

at a number of places. Perhaps the center offering instruction most suited to the prospective radioisotope user is the Oak Ridge Institute of Nuclear Studies located at Oak Ridge, Tennessee. The Institute is a cooperative organization composed of the 24 southern universities that comprise its membership and representatives of the Atomic Energy Commission and of the Commission's industrial contractors in Oak Ridge. The Institute is the agency which knits these diverse groups into a new pattern of education. Under the direction of the Institute, the Division of Special Training offers a lecture and laboratory course of four week's duration in which the students perform a large number of experiments with radioisotopes.* Because of the reception that has been given the Institute's training course, the Commission is now planning to establish similar programs in several large metropolitan areas.

Also of interest to the prospective radioisotope user is the Oak Ridge National Laboratory's technical training course in health-safety. This training is available in the form of Atomic Energy Commission financed fellowships, and is administered by the National Research Council. The course includes basic physics, nuclear physics, and on-the-job training. Brookhaven National Laboratory also has a program which is quite similar to the technical fellowship program at Oak Ridge. This program also is administered by the National Research Council.** For the most part, the regular university programs offer primarily post-doctorate work in medicine, biology, and engineering, but do not include short, intensive courses in radioactivity. However, some of the more progressive educational institutions are beginning to offer some basic instructions in isotope techniques. The University of Colorado (Boulder), Harvard University, North Carolina State University, University of Rochester, Ohio State University, Columbia, Washington University at St. Louis, University of Michigan and several Institutes of Technology such as Carnegie, California and Massachusetts and others are examples. Further information can be obtained by writing to the appropriate institution.

The U.S. Public Health Service plans to offer in Cincinnati starting in September, 1950, a course to acquaint public health workers with radiological safety.***

Training programs sponsored wholly or in part by the armed services may also be of interest to public health workers. Although this training is not directly concerned with radio-

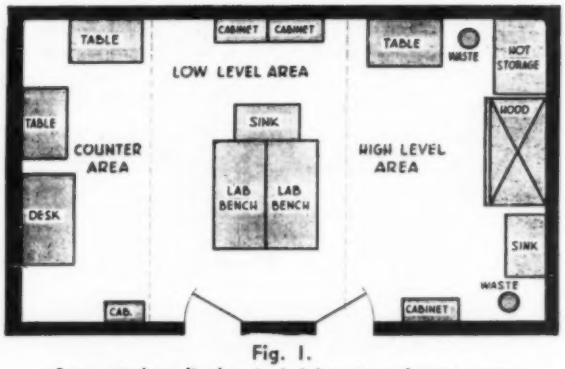

Fig. 1.
Suggested radiochemical laboratory layout recognizing three separate areas of operation

isotope application, it will undoubtedly be of interest to those seeking information in the field of radiological defense. Such programs include (a) a three-year curriculum developed jointly by the Radiological Safety Committee of the Army, Navy, Air Force, the Public Health Service and other agencies,* (b) six-week courses at Treasure Island, California, Biloxi, Mississippi, and Edgewood Arsenal, Maryland, for lower echelons, and (c) a one-week course at the Army Medical Center, Washington, D.C., for higher ranking officers.

Program Costs

PERHAPS one of the most important factors in planning the scope of a small radioisotope program is the budget limitation that may be established. The funds available will determine whether it will be possible to build a completely new laboratory incorporating a large number of desirable features or whether the facilities must be limited to alterations of an existing laboratory that may necessitate putting up with a considerable number of inconveniences. If the budget must be drawn up during the planning stage of the program it should be left as flexible as possible.

Laboratory: The first major item of expense is the laboratory (hoods, furniture, etc.). The total requirements, which will vary with the types and amounts of isotopes used, largely determine the cost. It is desirable to have the laboratory segregated into three parts (in the case of low-level, weak beta emitters, one room will suffice). These include: (a) a small area for "hot" storage and sample dilution; (b) an area in which the work with lower levels or with assay samples is conducted; and (c) an isolated area for counting. A diagram of a laboratory for work at low millicurie levels of radioactivity incorporating these principles is shown in Fig. 1. The air-flow pattern should be from areas of low radioactivity to areas of higher radioactivity. This means locating the

*The course deals primarily with isotope techniques and costs $25. Further information can be secured from Dr. R. T. Overman, Director of Special Training Division, Oak Ridge Institute of Nuclear Studies, Oak Ridge, Tennessee.

**The duration of the course is one year and carries a stipend of $125-$200 per month. Complete information regarding these fellowships may be obtained by directing an inquiry to the National Research Council, Washington 25, D.C.

***Further information can be obtained from Dr. S. Kinsman, U.S. Public Health Service, Cincinnati, Ohio.

*Additional information on this three-year course may be had by addressing a request for DCO Circular No. 32-48 to the Federal Security Agency, Public Health Service, Washington 25, D.C.

hood in the hot area where it is logically needed most. For work at tracer levels of radioactivity, a regular laboratory fume hood with a few modifications will suffice. All evaporations and other processes likely to spread radioactive contamination to the air should be performed therein. A satisfactory hood for radioisotope work is shown in Fig. 2. Adequate shielding from pure beta ray sources inside the fume hood can be achieved by the use of thick plastic (approximately one-half inch for hard beta ray emitters such as phosphorus 32). Because of their greater penetrating power, isotopes emitting gamma rays require for personnel protection the use of more dense shielding (lead or iron), or a greater distance from the source.

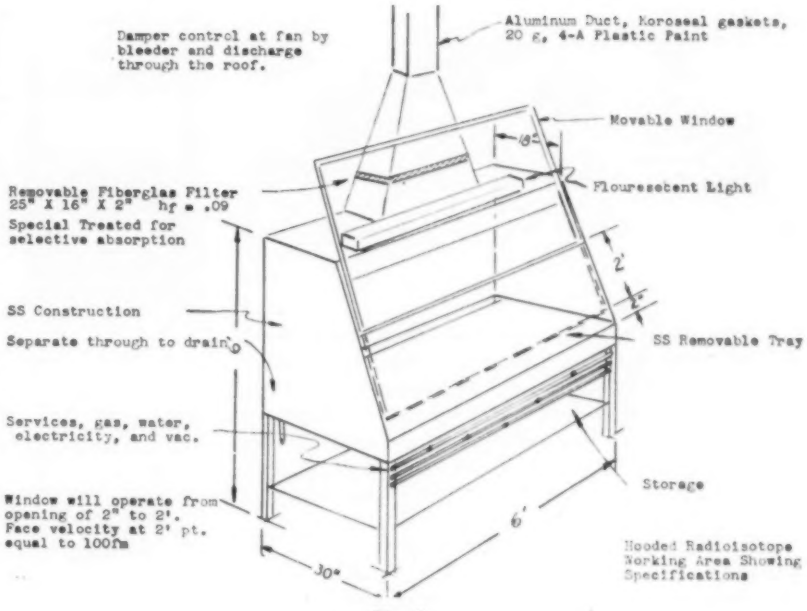
Damper control at fan by bleeder and discharge through the roof.
Aluminum Duct, Koroseal gaskets, 20 g, 4-A Plastic Paint
Movable Window
Flouresecent Light
Removable Fiberglas Filter 25" X 16" X 2" hf = .09
Special Treated for selective absorption
SS Construction
Separate through to drain
SS Removable Tray
Services, gas, water, electricity, and vac.
Storage
Window will operate from opening of 2" to 2'. Face velocity at 2' pt. equal to 100fm
Hooded Radioisotope Working Area Showing Specifications

Fig. 2.
Suggested radioisotopes hood for tracer work

Radioisotope laboratories should be properly marked for identification, and unauthorized personnel kept out including the janitor and special-service personnel who are apt to enter after regular working hours. The laboratory should be locked during the time a responsible user is not present.

A great deal has been written about the selection of structural materials for use in isotope facilities. One school of thought is that stainless steel is necessary for protective coverings in areas that are subject to radio-chemical contamination. However, this idea is generally a carry-over from the large Commission laboratories handling hundreds of curies. Information is available on the results of a testing program[4] to determine the feasibility of using materials cheaper than stainless steel for laboratory construction. It was found that several commercially available coatings are practically as good as stainless steel for many applications, and that some actually can be decontaminated to a greater degree. It is generally agreed that stainless steel can be used advantageously in certain areas; two of these being the sink which is used for discarded radioactive wastes, and the work surface of the fume hood. Cold-rolled stainless steel, which is comparatively inexpensive, is practically as good as polished stainless steel from the standpoint of decontamination and is usually cheaper and easier to fabricate.

Instrumentation: The second major item of expense is the radiation measuring equipment. This includes Geiger-Mueller tubes and scalers as well as surveying and monitoring instruments.[5] However, the cost of these items can be held to a minimum if first-hand experience with an instrument is obtained before buying it.

Miscellaneous Materials: The third item of expense is the special handling equipment such as a remote-control pipetting device, special tongs, storage containers, and special shielding equipment. However, the cost of these items can also be held to a minimum if the worker is capable of adapting them from standard laboratory items. Much of this equipment, as illustrated in Fig. 3, can be constructed, and will be entirely satisfactory for the remote handling and processing of the radioisotopes.

The expendables (chemicals, glassware, etc.) in an isotopes laboratory are slightly higher than those in other laboratories doing comparable work. Obviously, interchange of equipment with non-radioactive laboratories is prohibited.

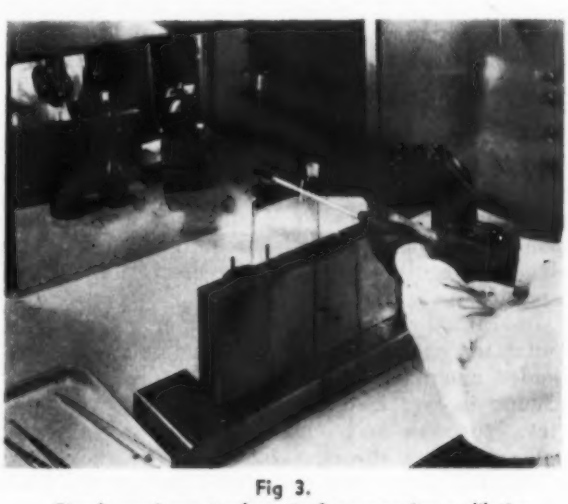

Fig 3.
Simple equipment adequate for preparing a dilution of 10 millicuries of radioiodine (I^{131})

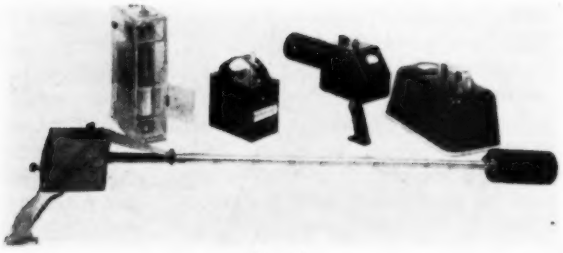

Fig. 4.
Radiation survey instruments

The radioisotopes usually are not a big item of expense. The current price for radioactive iodine 131 is $1 per millicurie and radioactive phosphorus 32 is $1.10 per millicurie plus a moderate handling charge.[6] Many synthetic organic compounds labelled in the desired position within the molecule are commercially available and can be obtained on allocation.

The cost of outfitting such a laboratory illustrated in Fig. 1 (hoods, furniture, instruments, shielding, etc.), exclusive of the cost of the room, can be held to less than $5000.

Health-Physics

THE levels of activity handled in most laboratories are lower by a factor of several million than those handled in Commission laboratories. Therefore, the scope of the health-physics program should be adjusted to meet the particular situation.[7]

If a laboratory is using comparatively small amounts of radioisotopes, it is unnecessary to set up an elaborate health-physics program. It should be pointed out that most of the isotope shipments from Oak Ridge are approximately 20 to 30 millicuries of short-lived isotopes (P^{32} and I^{131}), and most of the experimental work is performed in micro or low millicurie ranges.

Specific information on the minimum requirements that must be met before radioisotopes may be received can be obtained from the Isotopes Division.[6] The minimum requirement includes the possession and use of a calibrated survey meter for determining radiation field intensity and for locating contamination, and laboratory facilities appropriate to the type and quantity of isotopes used. Personnel monitoring devices such as film badges, film rings, pocket ionization chambers or dosimeters are recommended in most cases. The purchase of more elaborate equipment is at the discretion of the laboratory.

In Fig. 4 are shown a number of suitable ionization chamber survey instruments. The extended chamber on the instrument in the foreground is for the purpose of reading over barriers, through holes, and around corners without subjecting the operator to undue radiation.

Routine personnel monitoring is accomplished by using one or more of the detection devices shown in Fig. 5. These are (from left to right) a standard type of film badge, a finger ring film badge (below), a dosimeter, and a pocket ionization chamber.

Fig. 5.
Personnel monitoring devices

The health-physics records should include (a) radioactive materials received and dispensed for various uses, (b) personnel exposure, (c) laboratory or area surveys, and (d) waste disposal records. The first two are recommended for *all* radioisotopes; the last two should be kept for the long-lived radioisotopes.

Waste Disposal

DISPOSAL of radioactive wastes presents a problem that is unique. Since radioactivity cannot be neutralized nor its rate of decay altered, its disposal must be carefully controlled either by dilution to a non-hazardous concentration, or by storage until the activity has decayed to a negligible value. The problem of waste disposal is being given considerable attention at this time by the National Committee on Radiation Protection and some recommendations have been made.[8] These include (a) dilution and dispersion, in which special consideration is given to the nature of the diluting medium, and (b) concentration and confinement. Means for accomplishing the concentration include evaporation, precipitation, ion exchange, and incineration.

The U. S. Public Health Service and the Atomic Energy Commission are cooperating actively in the field of radioactive waste disposal. The following lines of research are under way.

Effects of Radioactivity on Sewage Systems: The Department of Sanitary Engineering, New York University, has a research contract for studying the effects of radioisotopes on sewage treatment processes to determine the concentra-

tion of waste that can be discharged safely into sewage systems. One of the features of this study is the availability of a sewage treatment plant with a capacity of 100,000 gallons per day which can be run on a pilot plant basis. The Sanitary Engineering Department of the Johns Hopkins University is studying the effect of concentration of radioactivity by bacterial slimes and associated problems. Oak Ridge National Laboratory is working on a similar project with the cooperation of the U.S. Public Health Service and the Sanitary Engineering Department of the T.V.A.

Biological Concentration Processes: The U.S. Public Health Service and the University of California are cooperating with the Atomic Energy Commission at Los Alamos on studies dealing with the concentration of radioactivity by the use of activated sludge.

Filter and Dust Collection Methods: The Harvard School of Public Health is studying the applications of supersonic chambers and the use of sudden cooling of supersaturated air to remove dust particles. The Arthur D. Little Company, the Carbide and Carbon Chemicals Division of Union Carbide Corporation and the Chemical Corps of the U.S. Army are cooperating in the design and production of special filters for removing small air-borne particles.

The diversity of approaches and the range of special abilities that are being applied would seem to insure in time a satisfactory solution to many of the puzzling questions in the field of waste disposal. Studies dealing with additional problems more closely related to the field of public health such as cancer, heart disease, control of epidemics (especially by waterborne bacteria, and air-borne pollution, etc.) await primarily the availability of personnel trained in the use of radioisotopes.

Conclusions

ADEQUATE preliminary training is essential if one is to avoid pitfalls encountered in the design of radioactive laboratories, purchasing of equipment, drawing of false conclusions from experiments, etc. All aspects of the planned program should be investigated thoroughly before any definite action is taken. Budgetary considerations can be met by careful program planning, careful design of the laboratory, and judicious selection of equipment. Sources of information and assistance are available by means of which starting a small isotopes program can be more readily accomplished.

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Physicians' Responsibility

IN EXTENDING the scope of industrial health service, three groups should cooperate: the medical profession, the governmental agency, and industry itself. The understanding and cooperation of the individual are essential to best results. This does not add up to the advocacy of a complete medical care program in industry. But the private physician must take the lead in improving the conditions under which large groups of people work, and in the prevention of both occupational and non-occupational diseases and accidents. Trade unions and general labor groups more and more are showing interest in the establishment of medical care programs. Unless the private physician assumes his responsibility for maintaining the health of the worker, labor itself may take control of the medical care of its members. Industrial medicine today probably is doing more in health maintenance than any other branch of medicine. The beneficial results that are being widely shown by this interest point up the necessity of finding ways to extend this type of service to an ever-increasing number of people. Worker and industry alike are benefiting from industrial health programs, and their effects are correspondingly spread throughout the communities in which they operate.

—From "How Industrial Health Can Extend Its Scope of Service," by GRADIE ROWNTREE, M.D., presented before the Section on Industrial Medicine and Surgery, Southern Medical Association, St. Louis, November 15, 1950.

The Appraisal of Detergency Through Radioactive Isotopes

CAREY P. McCORD
and
RUSSELL L. ROBERTSON,
Detroit, Michigan

CONCURRENTLY, this Journal is publishing (page 549) "Planning a Small Radioisotope Program," by George W. Reid and Oscar M. Bizzell. The study now presented may serve as a precise example of the small-scale application of radioactive isotopes fully conforming to the requirements set forth in that article. This immediate article is devoted to the measurement of the detergent qualities of various industrial skin cleansers through the introduction of radioactive copper into a standard soil.

The Measurement of Detergency

THE over-all appraisal of the qualities of a cleansing agent is an exacting procedure extending well beyond the measurement of detergency alone. Manifestly mere detergency may be best secured through application of undiluted hydrocarbon solvents or strong alkalies, but clearly at the expense of skin preservation. The detergent of choice, either soap or synthetic, is one that quickly and satisfactorily removes all manner of soil, without any appreciable damage to the integument. Already this journal[1] has printed our concepts of dermal physiologic requirements in relation to detergents. That earlier report emphasized the need for the preservation of the skin's natural acid mantle through the avoidance of active alkalies. Somewhat apart from either detergency per se or skin physiology are such other practical factors as sudsing, rinsability, hard water action, nature and particle size of scrubber in granular soaps and other detergents, suitable mixtures of different scrubbers, color, odor, parasite invasion, etc.

The industrial worker is sensitive to properties of skin cleansers. Stoutly he may demand thick, creamy, quick lathering or conversely loose, large-bubble, flash sudsing. In general the workman's own estimate of a desirable detergent is prone to favor treacherous, harsh, quick cleansing agents but becomes the first to voice indignation when skin damage is incited.

The appearance of cleanliness is an insufficient index of soil removal. Imbedded soil defies eye appraisal. This is best exemplified in surgical operating room hand cleanliness wherein skin sterility becomes the major consideration. That statement carries no implication that continuous skin sterility is requisite to acceptable cleanliness for the industrial workman.

From The Industrial Health Conservancy Laboratories, Detroit, Michigan.

This work was conducted under a grant from the Sugar Beet Products Co., Saginaw, Michigan.

In the last mentioned citation is introduced a method for the quantitative measurement of detergency through the criterion of fluorescent agents included in the standard soil. That procedure is valid but is attended by minor defection in that the skin naturally is somewhat fluorescent and in that such method is not quantitative for pinpoint soil deposits such as in skin pores. Adjudged to constitute a superior method is the inclusion of a harmless type and quantity of some radioactive agent within a standard soil. Scaling readings made after the application of the soil prior to standard washing and then after appropriate washing, afford a percentile index of detergency.

The Standard Soil

OBVIOUSLY industry affords literally thousands of different soils. It is impossible even to collect all, nor may gain be expected by testing large numbers. Admittedly some few defy all ordinary soaps or other detergents and call for the judicious use of special chemical cleansers. For our purposes the experimental soil consisted of well carbonized crankcase oil, polymerized petroleum products, diluted with naphtha, and the radioactive isotope later mentioned. This soil in small constant quantity was spread onto measured and marked-off skin areas (1.5 inch circles) on the palm and hand back surfaces of all subjects. The soil was allowed to dry 10 minutes before first testing.

Choice of Isotope

UNDER optimal conditions the active agent should be built into the molecule of one of the major constituents of the soil such as the petroleum products. Since such substance is not immediately available although in early prospect, resort was made to a radioactive additive to the soil. It was desirable to rely upon an agent emitting the comparatively harmless beta rays and with a short half-life. Under the guidance of a local examining board of chemists, physicists, hematologists and physicians, and under the surveillance of the Atomic Energy Commission, copper 64 was selected. The half-life of this isotope is 12 hours, so that on arrival and prior to chemical manipulation this substance had passed beyond its first half-life. No precise virtue resides in copper 64. Any other guiding board might with propriety have selected some other relatively harmless isotope.

The Atomic Energy Commission with justification imposed many restrictions and safe-

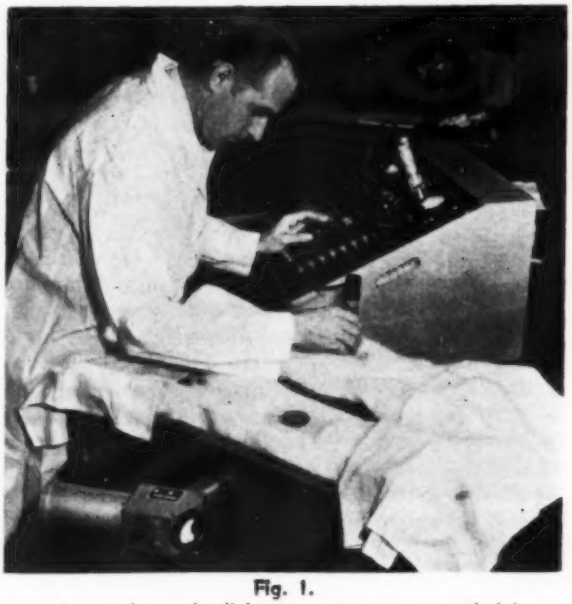

Fig. 1.
As a safeguard, all human tests were preceded by animal experimentation

Fig. 2.
Hand washing was conducted under standardized conditions

guards. Preliminary animal experiments were directed; planning by a local board was specified; the total radioactivity that might be introduced was designated; the number of tests per human subject was indicated; preliminary and subsequent blood counts for subjects were made requisite. While these restrictions are onerous and tedious, they are warranted. In full measure they have been faithfully followed in this project.

The preliminary animal studies with rabbits were conducted four months prior to human subjects. This animal work will not be presented here in detail. It may suffice to indicate that all steps were consonant with those conducted in later human applications. All results later proved to be consistent with human findings but human results are much more highly esteemed in drawing conclusions.

The Chemical Preparation of the Isotope

THE copper 64 as shipped, was in the form of metallic wire chips representing 100 millicuries. For our objective it was necessary promptly to transform this unit to a fine evenly dispersible precipitate of copper suboxide (Cu_4O) under conditions consonant with safety through appropriate protection. This was accomplished as to chemical procedure in the following manner:

Copper 64, weighing 0.32 g., was dissolved in concentrated nitric acid, 1.6 cc., and the fume dispelled from the acid nitrate. The acid nitrate solution was diluted to 50 cc. with distilled water. To this solution was added dextrose in an amount approximately equal to the weight of copper nitrate in solution, 0.96 g. Dilute sodium hydroxide (5.4% 20 cc.) was then added slowly till all the cupric nitrate was converted to cupric hydroxide. This step was concluded at the point when the gelatinous hydroxide began to redissolve. The solution was then set aside and allowed to stand until the copper hydroxide was well reduced to copper suboxide, but with some cuprous oxide present. The precipitate was washed and centrifuged three times with distilled water followed by two washings with 99% isopropyl alcohol. One half of the oxide was set aside for future use if necessary. The remainder was then thoroughly ground with the standard soil solution, and diluted to 50 cc. with standard soil, after which it was thoroughly agitated to insure dispersion. At the time the tests were run, the original 50 cc. dilution when mixed with an additional 50 cc. of standard soil was found to be radioactively satisfactory within the range suitable for human application.

Up to this point all activities had been conducted at our own laboratories with proper monitoring. All further laboratory action was now transferred to Radioactive Products Inc., under the direction of Mr. Homer Myers.

The Standard Wash

NO TWO persons lave in the same manner. Accordingly controlled washing was performed as follows: Three grams of every test detergent were utilized. A temperature near to 110°F was maintained. Washing was routinely carried out in basins to obviate temperature variations and different quantities of water inevitable in tap water; no brush or cloth was applied. The force, rate, and type of rubbing action were supervised. The time of one minute was clocked. Rinsing was carried out in basins and was supervised.

Routine Procedure

TWELVE adults were made the subjects for testing. On each subject, one by one, at appropriate intervals, circular areas were painted

evenly on the palm and back of one hand (later the other). After drying for 10 minutes these radioactive areas were counted under rigidly exact conditions with a Geiger counter, correctly calibrated. Suitable records were made. Soon thereafter a standard washing was conducted as above described. After rinsing and drying a comparable reading was made to measure the loss of radioactivity and thus the total soil. The ratio between these readings was expressed in percentage and was interpreted to represent the degree of cleansing achieved.

In like manner the other hand was later subjected to examination with another test material. The total radioactivity imparted to any one individual was well below the prescribed one microcurie. The four areas treated were designated as one test. Thus 46 areas were examined, involving 16 substances, on 12 subjects. Since additional counts were frequently made for accuracy, all told about 100 measurements were conducted. While this number of examinations was sufficient to establish the validity of the procedure, the number directed to any one product or substance is too small to justify conclusions as to the respective merits of individual examined items.

Work Materials

ALL well known brands of industrial detergents (not including liquid products) were obtained on the open market. In some instances chemical analyses were available but not necessarily on the identical package lot. Also several synthetic detergents were tested. One cake soap was included as a test item. Further some examined items representing non-commercial products were included to appraise the relative values of several scrubbers such as corn meal, wood meal, cob meal, rice hulls. Some variation was introduced in the size of scrubber particles, alkali content, etc.

TABLE I.
RESULTS OF DETERGENCY STUDIES

		Before Washing				After Washing		
	Subject	Area of Hand	Observed Count*	Net Count**	Detergent	Observed Count*	Net Count***	Percent of Soil Remaining****
1.	S	left palm	3210 ± 2%	3110 ± 2%	A	141 ± 6%	41 ± 10.4	1.31 ± .33%
		left back	3600 "	3500 "	A	109 "	9 9	.26 .26
		right palm	3450 "	3350 "	B	168 "	68 12	2.02 .34
		right back	4220 "	4120 "	B	100 "	0 9	0 .24
2.	M	left palm	4050 "	3950 "	D	213 "	113 14	2.86 .35
		left back	4300 "	4200 "	D	143 "	43 10	1.02 .25
		right palm	3950 "	3850 "	A	128 "	28 10	.73 .26
		right back	3750 "	3650 "	A	122 "	22 9	.60 .26
3.	J	left palm	4980 "	4880 "	C	340 "	240 16	4.91 .32
		left back	5080 "	4980 "	C	137 "	37 10	.74 .20
		right palm	4400 "	4300 "	E	980 "	880 59	20.5 1.4
		right back	3700 "	3600 "	E	158 "	58 11	1.61 .31
4.	S, Sr.	left palm	3820 "	3720 "	I	115 "	15 9	.40 .25
		left back	3900 "	3800 "	I	98 "	−2 8	0 .25
		right palm	3350 "	3250 "	K	211 "	111 14	3.41 .43
		right back	2280 "	2180 "	K	107 "	7 8	.32 .39
5.	S, Jr.	left palm	3650 "	3550 "	C	111 "	11 9	.31 .25
		left back	3700 "	3600 "	C	111 "	11 9	.31 .25
		right palm	3450 "	3350 "	B	96 "	−4 8	0 .25
		right back	3300 "	3200 "	B	96 "	−4 8	0 .25
6.	JR	left palm	3600 "	3500 "	M	460 "	360 27	10.3 .77
		left back	3480 "	3380 "	M	130 "	30 10	.88 .30
		right palm	3450 "	3350 "	J	850 "	750 51	22.4 1.5
		right back	3000 "	2900 "	J	120 "	20 9	.69 .32
7.	H	left palm	3750 "	3650 "	G	102 "	2 8	.05 .25
		left back	3620 "	3520 "	G	105 "	5 8	.15 .25
		right palm	3650 "	3550 "	H	165 "	65 12	1.83 .34
		right back	3300 "	3200 "	H	88 "	−12 8	0 .25
8.	RR	left palm	3450 "	3350 "	F	115 "	15 9	.45 .28
		left back	3800 "	3700 "	F	107 "	7 8	.20 .25
		right palm	3640 "	3540 "	D	145 "	45 10	1.27 .30
		right back	3070 "	2970 "	D	98 "	−2 8	0 .25
9.	WH	left palm	3200 "	3100 "	N	Subject wearing radium dial		
		left back	3450 "	3350 "	N	wrist watch on left hand		
		right palm	3000 "	2900 "	E	165 "	65 12	2.24 .41
		right back	3440 "	3340 "	E	175 "	75 12	2.24 .36
10.	L (woman)	left palm	2310 "	2210 "	O	107 "	7 8	.30 .30
		left back	2520 "	2420 "	O	88 "	−12 8	0 .30
		right palm	3000 "	2900 "	E	117 "	17 9	.59 .32
		right back	2650 "	2550 "	E	120 "	20 9	.78 .37
11.	P	left palm	3250 "	3150 "	O	282 "	182 18	5.78 .57
		left back	3250 "	3150 "	O	252 "	152 16	4.82 .52
		right palm	3190 "	3090 "	P	164 "	64 12	2.07 .39
		right back	1970 "	1870 "	P	133 "	33 10	1.83 .55
12.	HM	left palm	3850 "	3750 "	Q	121 "	21 9	1.76 .25
		left back	3600 "	3500 "	Q	103 "	3 8	.10 .25

* Measured rate in counts per minute with associated standard deviation of measurement in percent.
** Measured rate corrected for background counting rate of 100 counts per minute with associated standard deviation of measurement in percent.
*** Measured rate corrected for background counting rate of 100 counts per minute with associated standard deviation of measurements in counts per minute.
**** Percent residual soil in percent with standard deviation of measurement expressed in percent.

Fig. 3.
The type of scaling equipment applied in radioactivity measurements

Results

SINCE by design this article is descriptive of a method and not for the exploitation of any series of products, the names of no commercial products will be disclosed. Only generalities and trends are mentioned in Table I.

Removal of Radioactive Substances

IT WAS no objective of this study to provide or develop a detergent especially intended to serve in the event of atomic bombing or comparable situation. No statement may be made that our results are applicable to all radioactive isotopes. No less the implication from our sharply limited studies is to the effect that sodium bicarbonate added to detergents facilitates the disappearance of radioactivity. The rationale of this occurrence is not known. However undesirable this additive may be for routine industrial or household purposes, it may come about that in specific circumstances such as in the manufacture of isotopes or an atomic attack, detergents modified through the presence of about 20% sodium bicarbonate may be useful.

Comment

THE VOLUME of work embraced in this project is sufficient to support the procedure described. However that volume of work is insufficient to warrant firm conclusions. Therefore the following items of comment sometimes indicate appearances rather than rigid claims.

1. It is clearly established that soil removal from the palm of the hand is far more difficult than cleansing of the back of the same hand. The rationale of this lacking. Palmar thickening, rigidity of crevices, numbers of sweat gland openings, may be contributory.

2. Washing of any tenacious soil with water alone is essentially ineffective.

3. Sometimes synthetic detergents are highly effective in soil removal and perhaps more so than any true soap.

4. The presence of 20% sodium bicarbonate in detergent mixtures promotes the removal of the radioactive isotope elected for this study. It is specified that this additive is not commended for routine introduction into detergents designed for ordinary industrial or household usage. The mechanism through which sodium bicarbonate achieves removal of radioactive substances from the skin is unknown.

5. Apart from the chemical and physical properties of detergents the manner and extent of manual action and rinsing significantly influences final cleanliness.

6. Different scrubbers as cob meal, corn meal, rice hulls, etc., distinctly influence the completeness of soil removal. The present study disclosed that within the several scrubbers mentioned some are superior to others; particle size of scrubbers is significant; mixtures of different scrubbers and mixtures of different particle sizes modify the extent of detergency.

Summary

A METHOD for the appraisal of detergency is described employing radioactive copper as the tracer agent. Application demonstrates significant differences in the properties of divers industrial detergents. It is emphasized that high detergency alone is never a suitable index for the over-all appraisal of a detergent. Preservation of the skin is a requirement equal in import to soil removal.

Reference

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Surgical Lesions of the Spine

FREMONT A. CHANDLER, M.D.,
Professor of Orthopedic Surgery,
University of Illinois,
Chicago

IN PRESENTING the subject, "Surgical Lesions of the spine," one will recognize that any attempt to discuss a subject so varied and extensive would take far more than the allotted time. Some of the more common and better known entities will be discussed, with emphasis on certain basic principles.

A review of the anatomy of the spine is essential. The vertebral column is composed of a series of articulating vertebrae having a unique form and structure. The vertebra consists of a somewhat cylindrically-shaped body composed of cancellous bone. The superior and inferior surfaces are somewhat parallel, articulating with the intervertebral disk above and below. Projecting posteriorly from the margins of the vertebral body are the pedicles. These extend posteriorly to form the antero-lateral margins of the neural canal and join in forming a lateral mass of vertebrae. This consists chiefly of the transverse processes and the superior and inferior articular processes, and extends posteriorly to form the laminae on both the right and left sides. The laminae in turn fuse in the mid-line forming the spinous process. On both the right and left sides, we have the superior articular facets as well as the inferior articular facets. These are important structures and frequently have gone almost unnoticed. These are true joints having all the elements of any major joint—articular cartillage, capsular ligaments, synovia, reinforcing ligaments, and synovial fluid. The vertebral body articulates above and below with the intervertebral disk, a structure which has come to great prominence in the last few years, especially since the publication of the most important paper by Mixter and Barr in 1934. The disk itself is a cylindrical-shaped structure consisting chiefly of the annulus fibrosis and the nucleus pulposus. This subject of disk will be treated more extensively later in this presentation.

It must be remembered that the entire spine is held together by strong ligamentous structures, the chief of which are the anterior longitudinal ligament, the posterior longitudinal ligament, and the ligament bridging between the margins of the lamina and spinous processes. The contributions of the late Dr. Arthur Davis have emphasized the great strength of the anterior longitudinal ligament and how this ligament may be utilized in the reduction of fractures of the vertebral bodies. The posterior longitudinal ligament is also of great importance in relation to the posterior protrusions of the vertebral disk. The ligaments connecting the margins of the laminae are unique in character. The deeper ligament, known as the ligamentum flavum, is formed of elastic tissue. Superficial to this is a ligament of white fibrous tissue which is inelastic, serving a function of a check ligament to motions of the spine. The ligament between the spinous processes is of white fibrous tissue with no element of elasticity present, here again serving as a check ligament preventing separation of the spinous process beyond a physiological point. Greater detail of the anatomy is available in any standard textbook on anatomy, and it is important to refer to such sources of information in dealing with the tremendous number of types of trauma which may be encountered in the spinal column.

EMBRYOLOGICAL defects and failures of normal development abound in great profusion, and a thorough understanding of these possibilities must be always in mind. Of all lesions of the spine, probably those due to trauma, direct or indirect, are of greatest interest at this particular time. These may consist of minor degrees of sprains and subluxations to the major fracture dislocations which are of a most serious import. In dealing with the relatively minor sprains and subluxations, it is well recognized that such conditions are more common in arthritis and in the presence of congenital anomalies or minor degrees of deformities of the vertebral column and component structures. When restricting ligaments made of white fibrous tissue are placed under tension, a point is reached where further separation of the parts is no longer possible and rupture of the ligaments takes place. This may be at the attachment of the ligament at its origin or insertion or in the main substance of the ligament itself, resulting in avulsion of the ligament from its bony attachment or in a fracture of the ligamentous tissue proper. The question of subluxations has been brought up many times and is debated from all angles. There is no doubt that the articular surfaces may slip past each other in minor degree, resulting in the so-called subluxations. This is seen in other joints in the body and especially in the presence of some joint irregularity or interposed soft tissue. Inasmuch as the joints of the vertebral column are true joints, especially in the region of the lateral facets, it is reasonable to recognize the possibility of a fold of synovia being caught or a ligamentous band or adhesion being present at these levels resulting in the clinical picture of local pain, postural distortion which may be relieved by manipulative measures. On the other hand, it must be recognized that

the impingement or so-called subluxation itself comes from positional changes similar in character to those used in manipulation, the resultant forces acting in such a simple movement as when picking a light object from the floor, may involve movements which in all respects are quite similar to those utilized by individuals who manipulate the spine to correct so-called subluxations. The capsular ligament about the lateral facets may be ruptured and the underlying synovia may be traumatized. At times, actual herniations of synovial tissue through the ligamentous tear are encountered. These are symptom-producing lesions, and are rarely recognized clinically, however, they are seen at time of surgical exposure of these areas of the spinal column. The many muscles which bridge between adjacent vertebrae are subject to trauma and although muscle tears are probably much less frequent than ordinarily thought, they are possible. Muscle has quite an element of elasticity and will stretch and in all probability the so-called muscle tears are the reflection of ligamentous damage of the underlying tissue, irritating the muscle and causing it to go into marked protective spasm. The tremendous variety of lesions of the soft tissues and the smaller elements of the posterior structures of the bony vertebral column do not permit a detailed discussion at the present time. The general principles, however, may be summarized as follows:

1. The soft tissues of fibrous character have no element of elasticity and on reaching maximum tension must tear or must be avulsed from their points of attachment.

2. Trauma and distortion of the articulating surfaces of the lateral facets disturb the normal functioning of these points with the resulting traumatic arthritis such as seen in other joints in which articular surfaces are incompatible. It is a well recognized fact that fractures and dislocations of the spine are always associated with damage to the posterior soft tissues, although these are not recognized in most of our x-ray interpretations.

NUMEROUS fractures of minor importance occur. Although these are classed as minor fractures, they may be major in their symptomatology. Most prominent of these are fractures of the transverse process. These are caused by direct or indirect force most frequently, however, by muscle contraction. These fractures are extremely painful in the early stages but respond very promptly to immobilization. Union of such fractures takes place by bony union if the fragments are in good apposition or by fibrous union, and although the appearance by x-ray may not be satisfactory, the functional result is almost invariably good. Symptoms persisting after the occurrence of a fracture of a transverse process would indicate damage other than to the process itself. Associated with such a lesion of the transverse process, there is probably some hemorrhage and resulting scarring of the general musculature. Because of this, it must be emphasized that prolonged immobilization is not indicated. This will only result in the fixation of the scarred musculature, limitation of motion, and will become a chronic source of disability. Next in frequency come the fractures of the spinous processes due to direct trauma or the result of avulsion of fragments of the spinous process on flexion injuries involving the spinal column. These are often associated with lesions of the interspinous ligament or the ligament joining the margins of the lamina. They are almost invariably present in a compression fracture of the vertebral body proper. Such avulsions are rarely visible in the x-ray film which reveals the compression fracture of the body, because of the over-exposure of the less dense posterior structures. Fractures of the laminae are common. These are often linear in type with little or no displacement unless the trauma is direct and of a major character. Such fractures usually go on to healing in a satisfactory manner, although non-union or fibrous union may be occasionally present. Injuries of the lateral facets are common and cause much pain and disability. Any distortion of this joint of the articular cartilage, the synovia or ligamentous structures results in a post-traumatic arthritis which on movement may be painful. The patient protects and avoids movement by muscle spasm or postural changes such as in sciatic scoliosis.

The great frequency of separation of the lamina at its narrowest point (the isthmus or pars interarticularis) and its relation to spondylolisthesis is beginning to be appreciated. The resulting separate neural arch is present in from 3.5 to 5% of individuals and has a direct relationship to the many cases of low back pain which are encountered in routine practice. A separate neural arch is usually considered as being of congenital origin although no direct proof has ever been established to substantiate such a statement. No such lesion has ever been demonstrated in an embryo although investigations have been made in many instances. Whether this is of congenital origin or subsequent development is of academic interest only, for the significance of such a separate neural arch is appreciated in its relation to trauma. It certainly predisposes to instability at this level.

Fractures of the pedicle are quite unusual, and are practically always associated with major fractures and fracture dislocations of this region. Fractures of the vertebral body proper are of greatest interest and in the long series of spinal trauma will constitute the major proportion of the cases. Fracture of the cancellous structure of the vertebral body disrupts the internal architecture of this structure and also disrupts the circulation by rupturing some of the numerous venous sinuses which constitute the circulation of the vertebral body. This results not only in the destruction of bone by fracture, but also

death of bone by aseptic necrosis. The severity of the fracture will depend upon the degree of damage done to the cancellous structure and secondarily to the disturbance of general postural alignment by distortion of the contour of the body proper. Any force causing fracture of the vertebral body must be transmitted through a vertebral column and consequently it must come through the substance of the intervertebral disk. Coincidental pathological findings of the disk are of frequent occurrence. When damage to the vertebral body is extensive, it must be remembered, however, that portions of the cancellous bone may be forced posteriorly encroaching upon the neural canal. The significance of these encroachments need not be emphasized in those cases in which cord damage accompanies spinal injury, for it is obvious that a posterior decompression although removing the bony resistance posteriorly does not correct the posterior protrusion of bony fragments which may press upon the cord structure itself.

THE SURGICAL treatment of fractures of the spine is non-operative in the majority of instances. Certain basic principles, however, must be applied. The realignment of the fracture fragments must be accomplished if possible. This is done by traction in the horizontal position, manipulation, and postural changes, primarily by hyperextension of the fractured area. The reduced fracture must be maintained in a corrected position sufficiently long to permit healing of the soft tissues and of the bony structures. The soft tissues will be well healed in a period of four to six weeks, but bone repair will take a period of four to six months and in some instances longer. The significance of aseptic necrosis of devitalized bone becomes apparent. This accounts for the delayed absorption and the collapse which occurs months later in certain instances. A long period is necessary for callous formation and complete organization of the new bony structure. This does not necessarily mean that the patient has to be in a horizontal position all this time; for maintenance of a corrected position may be accomplished by use of a plaster body cast and braces, in an effort to prevent contraction or contractures of the soft tissues. Exercises which are designed to counteract deforming forces may be employed even at an early date following the injury. The use of diathermy as a means of promoting more rapid healing of the fracture area may be questioned to a great degree. However, there is some symptomatic relief when it is employed, and the psychological benefit is not to be overlooked. When a fracture of a spine is complicated by damage to the spinal cord or to peripheral roots, a situation has developed which calls for skilled and trained surgical judgment. Two schools of thought exist. First, that exploration of the spinal cord would be accompanied by additional damage and permit swelling to become more destructive. The second school holds that early exploration is indicated. A spinal puncture would be of great assistance in deciding this for if a true block of the spinal canal exists, there is no question that exploration should be carried out as soon as the patient's condition will permit, for an encroachment of a bony fragment on the cord may be relieved by laminectomy. In performing such a laminectomy, it is essential that a search be made of the neural canal anterior to the dura. Occasionally, bony fragments can be detected by gentle palpation of the finger tip of the dura, care being used not to traumatize further the delicate structures of the cord. Should laminectomy be done, it would be well to consider the desirability of removal of the articular cartilage of the facets so as to permit fusion of the involved vertebra. This will add somewhat to the length of the operation and assurance that the patient's condition is satisfactory must be had before this is carried out. Consolidation of the entire fractured area is probably the best assurance of better function at the level of fracture.

In considering dislocations of the spine, the site of occurrence of uncomplicated dislocations is greatest in the cervical area. These accompany flexion injuries of this region and of necessity are complicated by ligamentous damage. The interspinous ligament is avulsed or torn directly, permitting flexion at this level. The ligament between the laminae is torn, the lateral articulations are displaced forward and often are locked in an anterior position. Occasionally, a reduction is spontaneous and x-rays show normal findings. In other instances, the locking persists and care must be exerted if traction is applied so as not further to displace the proximal portion of the spine by traction with the facets locked in a displaced position. After a reduction has been accomplished, the area must be immobilized sufficiently long to permit healing of the soft tissue by scar formation. Occasionally, such healing is not sufficient to maintain reduction and a recurrence of dislocation develops.

Should fixation appear to be insecure or recurrence of dislocation be present, it is good to consolidate the area surgically. This can be best accomplished by exposure of the laminae and fixation of the spine in a position of reduction by placing a wire around the proximal lamina and locking it over the spinous processes more distally. This will give good fixation, but in each instance it is desirable to add a bone graft to make it more permanent. Bone grafts taken from the ilium serve an ideal function in this area.

THERE is probably no subject of greater importance in the discussion of the surgical problems of the spine that that of the herniated intervertebral disk. Since Drs. Mixter and Barr presented a paper on herniated disks in 1934, tremendous attention has been aroused relative to the diagnosis and treatment of this entity. The normal function of the intervertebral disk

is to supply a flexible cushion and fulcrum between adjacent vertebral bodies permitting motion in all directions. The disk is constructed of a periphery of fibrous tissue which has been referred to as an annulus fibrosus. The center of the disk is semi-liquid in character and is the remains in the notochord of early embryologic life. In the normal vertebral column, the disk functions as an elastic fulcrum, permitting motion in all directions to the limit of the checking effect of the spinal ligaments and the bony contours of the lateral articulations. To function normally as an intervertebral fulcrum, the disk must of necessity be intact in shape, elasticity and composition. If the contour and the elasticity of the disk are lost by changes in its composition or contour, dysfunction of the spine at this level is distorted, the mobility of adjacent vertebrae is diminished, the lateral facets tend to override, and the margins of the vertebra come in close contact with one another, resulting in irritation and spur formation. There is no question that herniations of the intervertebral disk are of frequent occurrence. On the other hand, this does not mean that all herniated disks should be treated surgically. In all probability, a majority of herniated disks will absorb, and function of the spine be interfered with only to a very minor degree. On the other hand, if episodes of disability become major in character and the pain disabling, surgical treatment is definitely indicated. In order to carry out the surgical procedure effectively, accuracy of diagnosis, of course, is of primary importance. The use of opaque substance in the thecal space is advocated by many and undoubtedly has a good position in the diagnostic phase of this entity. The disability following many injections of this character frequently offsets the advantage. It must be remembered that, although many of the x-rays are positive in portraying the disk changes, especially a herniation, they may introduce an element of error. The same may be said of the diagnosis without the use of opaque material in the thecal space. Inasmuch as a normal disk acts as a fulcrum, a herniation of a disk would introduce a mechanical factor which would add to the insecurity of the spine, the fulcrum having been lost. This mechanical factor must be kept in mind in dealing with the disk problem.

In regard to the surgical treatment of herniated disks, two distinct schools have arisen; (1) the simple removal of the disk has proved satisfactory in many cases, but (2) the frequent recurrence of symptoms in the area of surgery has led many to feel that the removal of the disk alone is not sufficient to relieve symptoms and that some form of surgical fixation of the spine is definitely indicated. In many instances localized laminectomy may be desirable for a thorough exploration removal of a herniated disk. Some type of surgical fixation of the spine must be considered. A popular belief has been prevalent that in order to accomplish this, prolonged rest in bed is most desirable. This, however, is not necessarily the case, for means of immobilizing the spine while still permitting early immobilization have been devised. In dealing with a herniated intervertebral disk surgically, the operating surgeon must be in a position to remove the disk without injury to the adjacent structures, to meet with an unexpected possibility of spinal cord tumors, tumors arising from the spinal structures, and at the same time be qualified to carry out a satisfactory spine fusion operation of some type or other. It is my practice in exploring spines for herniated disks to fuse most of them surgically with a bone graft taken from the posterior part of the ilium and wired in place quickly to immobilize this area while osteogenesis is proceeding. The patients may become mobile in a few days and may usually be discharged from the hospital in from 10 to 12 days without restriction of plaster cast, braces, etc. Such a procedure has removed many of the disagreeable phases of such surgery experienced by the patient.

A SUBJECT also of great importance is that of spondylolisthesis in regard to disabling conditions encountered in the lower back. Although, as mentioned above, the origin of spondylolisthesis is not clear, its presence is undeniable for it exists in from 3.5 to 5% of individuals. The presence of such a lesion is without doubt the contributing factor to the vulnerability of this area to relatively minor strains and stresses. Its recognition is usually made easy by thorough inspection of this area, and especially by high quality x-rays that reveal the details of the region. A vast majority of such lesions occurs at the fifth lumbar and at the fourth lumbar, or occasionally at higher levels. Should symptoms be of a degree to justify the employment of surgical means for relief, some form of fixation is indicated. The possibility of spondylolisthesis being associated with a herniated intervertebral disk at the same level must always be kept in mind, and because of this an exploration of the extra-dural space at the level of the lesion is indicated. Some form of fixation extending to the normal vertebra above and to the sacrum below should be selected. A bone graft of the ilium or tibia is definitely indicated. In cases in which the displacement has been accentuated by trauma, some possibility of reduction of the anterior displacement may be accomplished, but, inasmuch as most of these cases are of a chronic nature, it is doubtful whether more than an occasional reduction may be brought about. Theoretically, fixation of the body anteriorly would be ideal from a mechanical standpoint, but this introduces many other factors which would mitigate against the success of this method.

CONGENITAL anomalies involving the lumbosacral area of the spine are of great variety and degree. Many of these introduce a struc-

tural factor which predisposes to instability of this area. Here again, the surgical approach is one of supplying stability to this area either by the use of an external apparatus or preferably by internal fixation with a well executed bone graft operation. Deformities of the spine such as scoliosis are encountered in increasing numbers, and many of these are of such a degree that surgical interference is fully justified. In each instance, however, an attempt should be made to reduce the deformity to the greatest degree, and the problem of fixation of the area of deformity then presents itself. This usually calls for the employment of bone graft operation using ilium or tibia or even bone from a well supervised bone bank. Although, many lateral curves may be stabilized, there are occasionally ones which may be completely corrected. The success of such an operation is dependent upon the reduction of the mechanics of the involved area from a column of multiple units to a single volumn brought about by consolidation through the graft procedure.

INFECTIONS of the spine are numerous in character; the one most familiar to us all is that of a tuberculous infection, or Pott's disease. Here again, fixation of the involved area is definitely indicated. The purpose of such fixation, however, is not completely to reduce the deformity but to immobilize the area of infection permitting healing. In the past, considerable attention has been given to reduction of the deformity, but in view of the experience of tuberculosis elsewhere, especially that involving the lungs, we appreciate that deformity of the lung is of secondary importance when considered in relation to healing of a tuberculous lesion. In Pott's disease, a spine fusion is merely an adjunct in the whole course of the healing process, it being the only means in which we can immobilize the area of infection. It is doubtful whether any attempt to prevent collapse of the diseased area should be made when collapse and obliteration of the area of disease are undoubtedly the best means we have of promoting fibrosis and eventual calcification of this area.

More attention should be given to the healing of the local lesion rather than to the prevention of the deformity. It is here that deformity undoubtedly aids healing. The secret of prevention of deformity is in the very early recognition of the disease process before the destructive lesion is too extensive.

Numerous other lesions of the vertebral column are present which should be treated surgically. The exact approach depends upon the location of the lesion, its type, etc. For instance, an osteoid osteoma of the spine can be treated only by complete excision and such excisions will depend upon the location in relation to the vertebral body or its various structures. Occasionally, a tumor of a benign character may develop within the substance of the body and here again its accessibility will depend upon its exact location. For instance, if the body of the fifth lumbar is extensively involved by a benign tumor, the approach is trans-abdominal with excision of the tumor mass and replacement with a form of bone graft. If such a procedure is contemplated, however, it would be well to do a preliminary spine fusion to add to the stability so desirable at the lumbosacral area before attempting excision through an anterior approach.

During recent years, an attempt has been made to correct the deformity of an ankylosing spondylitis by means of an osteotomy of the deformity and fusion of the osteotomized area. This is a hazardous operation at best and should be undertaken only with the full knowledge of the possibilities—the major one being the damage to the spinal cord when correction is obtained.

The spine is a frequent site of metastases of malignant tumors. There is little possibility of excision of such a tumor but the relief obtained by immobilization by means of spine fusion is frequently well worth subjecting the patient to such a procedure. The pain associated with spinal metastases is such that immobilization frequently gives considerable relief, and favorable results have been brought about in many instances by such a procedure.

Lesions of the spinal column are of such a wide variety and vary so much in degree that any attempt to discuss them in great detail would involve a discussion not permissible in a brief presentation.

Procedures to be carried out may be summarized as (1) immobilization by means of an external apparatus, (2) by manipulative procedure including traction, hyper-extension over sufficient periods of time to permit healing of traumatic lesions, (3) by laminectomy to relieve pressure upon the cord in the case of tumor or fracture to permit excision of herniated nucleus pulposus and neoplastic lesions, (4) by fixation of the spine by a form of spine fusion operation. Numerous types of spine fusion operations have been devised, and it is good for the surgeon to become thoroughly familiar with the various types of fusion now in use so that he can select the one best adapted to the case at hand. Internal fixation of the graft by means of wire or other forms of apparatus has reduced the long period of recumbency formerly thought necessary. There is no doubt that the trans-abdominal approach, the extra-peritoneal approach, and the transthoracic approach will be developed to a much greater degree in the near future, thereby making possible means of dealing with the lesions of the vertebral bodies.

(6 North Michigan Ave.)

Occupational Cancer in a Chromate Plant
—An Environmental Appraisal—

H. G. BOURNE, JR., and H. T. YEE,
Division of Industrial Hygiene, Ohio Department of Health,
Columbus, Ohio

IN 1948, Machle and Gregorius reported[1] the crude death rate for cancer of the lung among workers in seven United States plants engaged in the extraction of chromates from ore as 25 times the normal. They suggest that monochromates may be the compounds responsible.

With the object of adding to the knowledge of the role of chromium compounds in the incidence of respiratory cancer, epidemiological and environmental studies were conducted by the Ohio Department of Health in a single plant manufacturing sodium bichromate from chromite ore. A mortality study by Mancuso[2] revealed that the proportion of deaths from cancer of the respiratory system to that of all employee deaths in this plant was 14.7 times that in a non-exposed control group. The environmental phase presented here was undertaken to ascertain as far as possible the specific chromium compounds and magnitude of exposure experienced by workers according to their occupation and location.

Although a maximum allowable concentration of chromic acid and chromates was approved[3] in 1943, the role of chromium compounds as carcinogenic agents was not suggested in this country until 1948. There is no useful guide at present by which one may compare the carcinogenic hazards associated with exposure to specific concentrations of chromium compounds. Monochromates, as has been suggested, may be the causative agents, yet the evidence is fragmentary and one cannot exclude at the present time elemental chromium (Cr^0), trivalent (Cr^{+3}), or bichromate which also has a valence of +6. Therefore, the atmospheric chromium concentrations reported are expressed in terms of chromium ion, a departure from the customary industrial hygiene procedure in which concentrations are expressed in terms of chromic acid (CrO_3). Adopting this method of expression avoids the inference of implicating any specific chromium compounds for cancerous reactions.

The plant in which this study was undertaken has been in operation since 1932. In order to meet price and quality competition, improvements in equipment and processes have been made periodically during the past 18 years, and it is the universal experience of industrial hygiene personnel that greater process efficiency is almost invariably associated with a more healthful working environment. Therefore, there seems little doubt that atmospheric contamination in the past was greater than in early 1949 when the present work was commenced. Later in the same year the company initiated a comprehensive program designed further to improve the manufacturing efficiency and to reduce the exposure of the employees. Thus it is evident that the concentrations which have been recorded do not represent a static condition but only the situation prevailing during the first half of 1949.

The mean latent period for respiratory cancer in the chromate producing industry, according to Machle and the German literature, is approximately 15 years. Thus any present relationship between environmental exposure and incidence of cancer in the plant under study must be predicated on the assumption that the concentrations which are reported are probably the minimum values attained in the past 15 years.

Raw Material

CHROMITE ($FeO.Cr_2O_3$), lime, soda ash and sulfuric acid are the raw materials commonly used for the manufacture of sodium bichromate.[4] Typical proximate analyses of two South African ores,[5] the country of origin of the ore used by the plant under study, are shown in Table 1.

Table 2 gives a spectrographic analysis of a sample of ore dust obtained from the ore preparation department.

TABLE 1.
PROXIMATE ANALYSIS TYPICAL SOUTH AFRICAN CHROMITE ORE

	Percentage					
Country	Cr_2O_3	FeO	Al_2O_3	SiO_2	MgO	CaO
Rhodesia	51.1	11.4	15.2	4.8	12.7	0.9
Transvaal	45.6	25.8	14.3	1.4	11.8	trace

TABLE 2.
SPECTROGRAPHIC ANALYSIS OF A CHROMITE ORE

Element	Percentage	Element	Percentage
Aluminum	0.1 — 0.01	Magnesium	> 2.0
Calcium	0.1 — 2.0	Manganese	0.01 — 0.001
Cadmium	?	Sodium	< 0.001
Cobalt	0.01 — 0.001	Nickel	0.01 — 0.001
Chromium	> 2	Phosphorus	0
Copper	< 0.001	Lead	0
Iron	0.1 — 2.0	Silicon	0.1 — 2.0
Potassium	0	Titanium	< 0.001
		Vanadium	0.01 — 0.001

[EDITOR'S NOTE: This engineering material, dealing with the environmental background leading to chromium exposures, is to be followed by a report of clinical investigation. This report is not immediately available for examination and publication. While these present engineering data embrace several chromium compounds, it will not necessarily follow that all may act or act equally as carcinogens.]

TABLE 3.
RELATIVE COMPOSITION OF RAFTER AND AIR-BORNE DUST

Department	Major Compound in Process	RAFTER No. Samples	RAFTER Ratio $Cr^{+3}:Cr^{+6}$	RAFTER pH*	AIRBORNE No. Samples	AIRBORNE Ratio $Cr^{+3}:Cr^{+6}$	AIRBORNE pH
Ore Preparation	Chromite	5	17.0	10.4	11	52.0	8.3
Lime & Ash	Chromite	1	6.0	10.6	6	6.0	9.4
Roast	Monochromate	23	3.0	10.8	62	2.0	8.5
Filtering	Monochromate	3	3.0	10.4	10	2.0	7.1
Neutralizing	Monochromate	4	4.0	10.3	13	2.0	7.5
Liquor	Bichromate	6	0.5	8.0	12	2.0	6.7
Finish Crystals	Bichromate	4	0.5	7.9	12	1.0	6.7
Chrome Cake	Sod. Sulfate	2	4.0	11.2	3	1.0	8.8
Shipping	Bichromate	2	1.0	8.0	8	3.0	6.8

*10 g.p.l.

Process

THE manufacture of sodium bichromate in this plant is carried on in nine departments, their names being partially descriptive of the operation: (1) ore preparation (grinding ore); (2) lime and ash (mixing ore with lime and soda ash); (3) roast (heating the mix); (4) filtering (leaching out sodium monochromate); (5) neutralizing (removal of aluminum hydrate); (6) liquor (conversion of monochromate to bichromate and concentration); (7) finish crystals (separating sodium bichromate crystals from liquor); (8) "chrome" cake (processing sodium sulfate); and (9) shipping (drying and packaging). The chemistry of the process may be summarized by the following equations:

chromite + soda ash + heat = sodium monochromate + aluminum hydrate

sodium monochromate + sulfuric acid = sodium bichromate + sodium sulfate

Chemical Composition of Dust and Mist

THE employees of this establishment are exposed to chromite, sodium monochromate and bichromate in the form of air-borne dust and mist. Building construction was of such a nature that isolation of many departments and processes was not effected, and thus it was anticipated the air of all departments would contain each of the three chromium compounds. In order to ascertain the approximate proportion of each, samples of rafter dust and air-borne particulate matter, the latter collected by drawing air through suitable filter paper,[6] were obtained and analyzed polarographically.[7]

Differentiation between chromite and chromates was based on the assumption that the chromite (Cr^{+3}) was insoluble in water whereas the chromates (Cr^{+6}) were soluble. It was not found possible to separate monochromate from bichromate. It is reported,[8] however, the pH of a 200 g.p.l. solution of sodium chromate is 8.9 and that of sodium bichromate 3.3. Thus the pH of the samples should in some measure indicate the prevalence of monochromate or bichromate provided no other acid or alkaline material is present. The ratio of $Cr^{+3}:Cr^{+6}$ and pH of the rafter dust and air-borne particulate matter collected in each of the nine major departments are given in Table 3.

Two inferences may be drawn from the data in Table 3: first, insoluble trivalent chromium is greatly in excess of the chromate in seven departments and in the remaining two departments both are present in nearly equal amounts; second, the pH indicates a preponderating presence of alkaline compounds in the plant atmosphere, i.e., lime, soda ash, and sodium monochromate although the effect of the presence of bichromate is reflected in somewhat lower pH in those departments such as liquor, finish crystals and shipping where bichromate alone is in process.

Particle Size of Mist and Dust

BY PRECIPITATING dust and mist electrostatically on a bright-line haemacytometer it was possible to determine the particle size distribution of mist and solid particulate matter dispersed in the workroom atmosphere. The median size of in-plant air-borne dust was found to be 1.7 microns. In the finish crystals and liquor departments the mist had a median size of 3.8 microns. It is reported[9] that the median size of industrial dust in general is 1.4 microns.

Departmental Chromium Concentration

THE concentration of the trivalent and hexavalent chromium dust and mist present in the air of each of the nine departments is shown

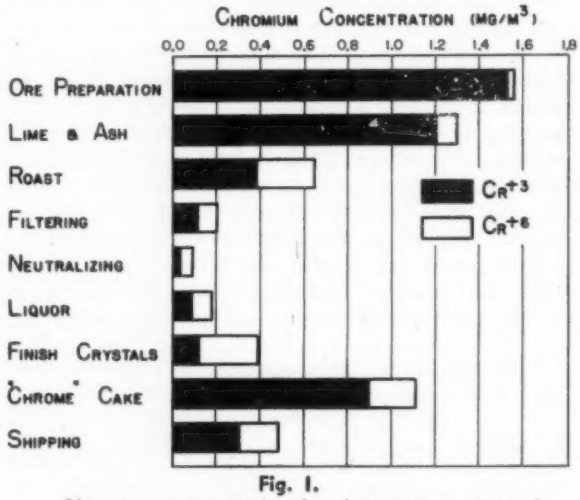

Fig. 1.
Chromium concentration by departments engaged in production. Sodium sulfate by company nomenclature is known as "chrome" cake

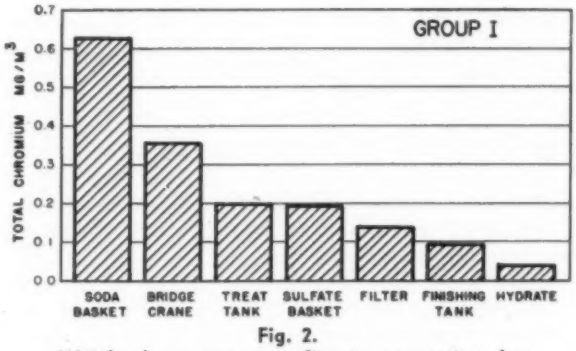

Fig. 2.

Weighted exposure according to occupations having Cr^{+3}: Cr^{+6} ratio of 1 or less. Sodium bichromate and sulfate centrifuges are known in company nomenclature as soda and sulfate baskets respectively

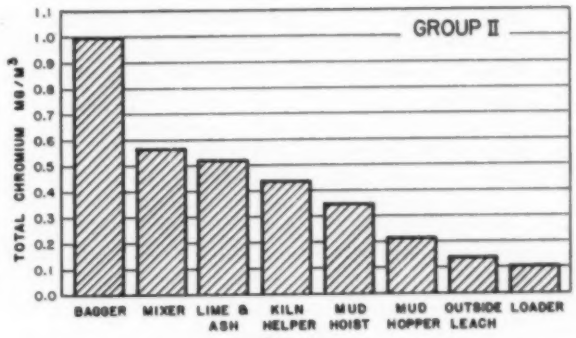

Fig. 3.

Weighted exposure according to occupations having Cr^{+3}: Cr^{+6} ratio of 1.1 to 4.9

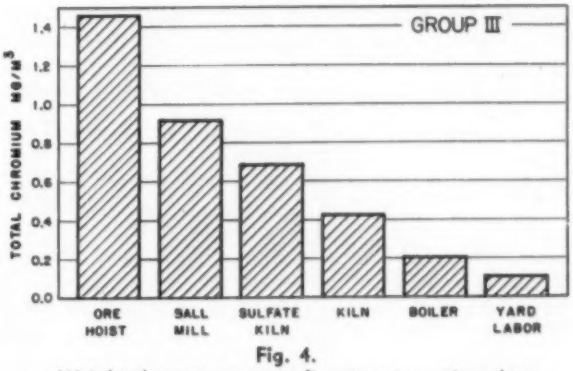

Fig. 4.

Weighted exposure according to occupations having Cr^{+3}: Cr^{+6} ratio of 5 or more

in Fig. 1. The values are based on 121 samples collected by the filter paper technique and analyzed using the polarographic method. The rate of air flow was measured with an orifice-variable area meter.[10]

Exposure of Production Workers by Occupations

ON THE basis of company employment classifications, observation of work performed and degree of exposure as estimated by visual observation, the 128 production workers were grouped into 21 occupational classifications. One or more representative individuals of each occupation were then time-studied for eight-hour periods, and the data so obtained were applied by a method described in the literature[11] to arrive at a weighted average eight-hour daily exposure. From the weighted exposures the ratio of Cr^{+3}:Cr^{+6} was also computed for each occupational classification.

On the basis of Cr^{+3}:Cr^{+6} ratio, the 21 work classifications were sorted into three groups. Group I has a ratio 1.0 or less. It contains the individuals processing sodium monochromate and bichromate liquor and those required to work in close physical proximity to such operations. Their exposure in total chromium is shown in Fig. 2. Group II with a ratio greater than 1 and less than 4.9 (Fig. 3) appears to have a distinctly dual exposure, i.e., sodium monochromate and ore dust; shippers (bagging, loading) are exposed to bichromate and ore. Group III, whose ratio is 4.9 or greater (Fig. 4), comprises occupations primarily exposed to trivalent chromium. It should be pointed out that while the average Cr^{+3}:Cr^{+6} ratio for all kiln operators is 7, for those whose work location adjoins the filtering department it is 1.4. Therefore, these particular operators might be included in Group II.

Distribution of Maintenance Workers' Time

THE 76 maintenance workers comprised approximately 30% of the total plant personnel, and observation of the conditions under which much of their work was performed indicated a potentially high degree of exposure. It was deemed necessary, therefore, to time study this group as thoroughly as the production workers.

Obviously, the nature and location of repair work is non-repetitious and must be performed as the occasion demands. A time study similar to that used for production workers could not be properly applied to maintenance personnel; hence a different approach became necessary.

Using the cost of maintenance labor over a year's time as charged to each department by the company accounting office the average man-hours of maintenance expended in each department per day were calculated. Based on the records of the maintenance superintendent and types of process equipment repaired and installed, man-hours maintenance according to crafts were then ascertained for each department. Since time charged to a specific work order might involve work in both the plant and the maintenance

TABLE 4.
DISTRIBUTION OF MAINTENANCE TIME BY CRAFTS

Craft	Department or Location				
	Ore Preparation	Roast	Filtering	Liquor	Maint. Bldg.
Welders	¼ hrs./da.	½ hrs./da.	¼ hrs./da.	0 hrs./da.	6 hrs./da.
Electricians	½	¾	½	¾	1½
Millwrights	1½	½	¼	½	1½
Pipefitters	¼	¼	1¾	1½	1
Boiler-makers	¼	3	¼	0	2½

building, further adjustments were necessary.

In Table 4 the time distribution of five crafts according to selected departments is shown as an example.

Exposure of Maintenance Workers

UNLIKE production employees, maintenance workers seldom work under normal conditions in a plant. The work necessary to complete their assignments almost invariably results in abnormally high local exposures. The plant under study is no exception since it was observed huge volumes of dust were generated during the repair and cleaning of dust collectors, process equipment or building structure overlaid with an accumulation of dust. It is thus logical to assume the maintenance group receives, in most instances, a greater exposure than production workers.

In Table 5 a minimum and maximum weighted average exposure derived from time study and concentrations, as well as Cr^{+3}:Cr^{+6} ratio, of maintenance employees by crafts are shown. The minimum levels are based on average departmental concentrations measured under normal operating conditions, and the maximum levels are reported on the basis of the highest concentration recorded in each department.

TABLE 5.
EXPOSURE OF MAINTENANCE EMPLOYEES BY CRAFTS

Craft	Weighted Average 8 Hour Exposure, mg/m³ Total Cr		Cr^{+3}:Cr^{+6} ratio
	Minimum	Maximum	
Handy Men	1.15	1.62	27.8
Millwrights	0.66	3.34	7.3
Maintenance Superintendent	0.55	2.13	4.5
Electricians	0.48	5.67	3.0
Boilermakers	0.44	4.43	2.4
Painters and Riggers	0.42	1.32	4.3
Oilers	0.41	1.94	2.2
Pipefitters	0.28	2.31	2.1
Carpenters	0.27	0.43	3.5
Welders	0.23	2.20	4.8
Machinists	0.07	0.13	6.0

Exposure of Administrative and Technical Personnel

THE administrative and technical staffs together constituted only a small minority of the plant's personnel, accounting for the remaining 21 of the 226 plant employees. With the exception of the plant superintendents and supervisors, this group's work was largely carried out in an office building situated nearby the production buildings, and it is believed their exposure is the result of infiltrated air and contaminated apparel. Grinding and handling samples in the course of making control analyses undoubtedly account for the higher exposure of laboratory personnel (Table 6).

TABLE 6.
EXPOSURE OF ADMINISTRATIVE AND TECHNICAL PERSONNEL

Occupation	Weighted Average 8 Hour Exposure, mg/m³ Total Cr	Cr^{+3}:Cr^{+6} ratio
Superintendents	0.18	3.5
Plant Supervisors	0.63	3.2
Office Workers	0.06	5.0
Laboratory Personnel	0.27	17.0

Conclusions

ALTHOUGH the environmental investigation presented here pertains to a single plant, it is believed that the conclusions that follow may be applied to other plants manufacturing sodium bichromate from chromite ore.

1. Where unit operations are not isolated or adequate dust and mist control established employees may be subjected to a dual exposure, i.e., trivalent chromium (chromite) and hexavalent chromium (chromates). In the plant studied the predominant exposure, based on both magnitude of chromium concentration and number of employees, was to the trivalent compound.

2. In the plant studied, all employees were exposed to measurable amounts of chromium. The lowest concentration which is carcinogenically significant is yet to be determined.

3. Observations during the course of this study convince the authors that the carcinogenic hazard in the chromate producing industry can be controlled successfully by utilizing industrial hygiene engineering methods employed in the safe handling of other toxic chemicals, i.e.:

(a) Undertake through adequate ventilation the control of dust and mist with the ultimate goal of securing the minimum concentration consistent with good engineering practice. Removal of toxic matter from air exhausted to the out-of-doors is essential to prevent a neighborhood public health hazard.

(b) Isolate dust and mist contributory operations, and mechanize where practicable to reduce the number of employees exposed.

(c) Provide under positive pressure uncontaminated air to personal services and process observation rooms or locate such rooms in uncontaminated areas.

(d) Insure good housekeeping by proper building design and adequate janitor services.

(e) Educate employees in personal hygiene and acquaint them with provisions made for their safety.

(f) Supply personal respiratory protective devices approved by the U. S. Bureau of Mines.

4. Establish laboratory facilities and provide technical personnel to measure the concentration of air-borne chromium compounds. Current knowledge of the degree of atmospheric contamination will provide an index of the effectiveness of the control measures as well as directing attention to sources of pollution that have been overlooked.

[ACKNOWLEDGMENT: This project was supported by a cancer control grant from the National Cancer Institute, U. S. Public Health Service, CS-887, THOMAS F. MANCUSO, M.D., Project Director.]

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That Tired Feeling

THE STATE of being tired is experienced by almost everyone at some time or other. It is a natural feeling at the end of a hard working day, but one that is supplanted with new energy after a refreshing sleep. The fatigue that is always present is the fatigue brought about by a long period of overwork, or late hours with little rest, or meals that do not provide the fuel necessary to maintain the machinery of the body. The maximum of production cannot be obtained from long hours of overwork. Efficiency is lessened to the degree that a worker comes to his job as tired as he left it the night before. The physical fatigue resulting from overwork, either mental or physical, is responsible for the saying "too tired to eat." The body needs fuel, it needs to replenish its stock of energy with energy-producing foods, and this can be done by means of a well-balanced diet. Sugar is needed to combat fatigue. When the blood sugar is depleted, many cases of fatigue and tiredness occur, even to the point of collapse. Numerous conditions stem from fatigue. Again fatigue may stem from various diseases, infection, improper hygiene, too much mental effort, inadequate nutrition. Many accidents can be charged to fatigue. For that tired feeling in the overworked person, a change of hours is recommended. There should be a shorter working day and a brief spell of relaxation, as recreation is important. For exhaustion in a nervous person, it has been found that complete rest in bed aggravates rather than relieves the condition, particularly for chronic nervous exhaustion. Such a person should be encouraged to carry on consistently from day to day, if only in a limited way. In general, however, rest is the best treatment for all types of fatigue. Physical activity should be decreased as much as possible, and such stimulants as coffee, tea and "cokes" should be abandoned or, at least, the use of them curtailed. Consult your doctor. He is the person to investigate the reasons for your fatigue. If a glandular disturbance is responsible, he will detect it. Self-medication won't help. Let your doctor lead you into a balanced social and business way of living. The fatigued person is one who, in his tired state, contributes little to his own enjoyment and nothing to that of any one else. Time passes too quickly to be too tired to enjoy its interest.

—Educational Committee, Illinois State Medical Society, *Health Talk*, November 23, 1950.

Atmospheric Pollution in the Vicinity of a Chromate Plant

H. G. BOURNE, JR., and W. R. RUSHIN,
Division of Industrial Hygiene, Ohio Department of Health,
Columbus, Ohio

REPORTED occupational respiratory cancer among workers engaged in producing chromates from chromite ore[5] and non-occupational berylliosis in the vicinity of a plant producing beryllium[4] led the authors to investigate atmospheric pollution by chromium compounds in the vicinity of a plant producing chromates from chromite ore. A knowledge of the degree of exposure of persons residing in the neighborhood of such a plant is one of two essential steps necessary to ascertain if a relationship exists between exposure to chromium and epidemiological evidence of cancer. It is the purpose of this paper to report the ground level concentration of chromium at various distances leeward of this plant.

The continuous process by which sodium bichromate is manufactured from chromite ore in the plant studied is essentially the same as that outlined by Partington.[6]

An investigation conducted simultaneously with the project presented herein revealed that employees within this factory were exposed to air-borne dust and mist containing chromite, sodium monochromate and bichromate. These compounds are similarly contained in the exhaust air that is discharged to the out-of-door atmosphere through 12 stacks ranging in height from 62 feet to 78 feet above ground level. Other sources of contamination such as outside ore piles, dust covered buildings, and the yard area contribute to the atmospheric pollution.

The apparatus used to collect duplicate samples of the atmospheric dust consisted of twin filter-paper holders and air flow meters[3] connected to a gasoline-engine-driven vacuum pump. In operation, the apparatus (Fig. 1) was mounted in a vehicle and transported to sampling points located from 100 to 10,000 feet downwind of the plant.

This project was supported by a cancer control grant from the National Cancer Institute, U.S. Public Health Service, CS-887, THOMAS F. MANCUSO, M.D., Project Director.

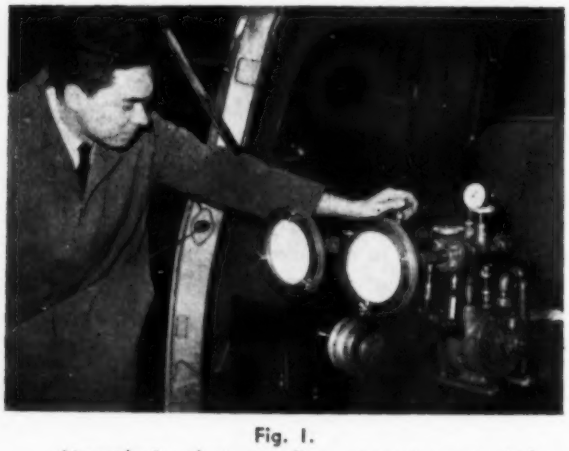

Fig. 1.
Atmospheric dust sampling apparatus mounted in vehicle

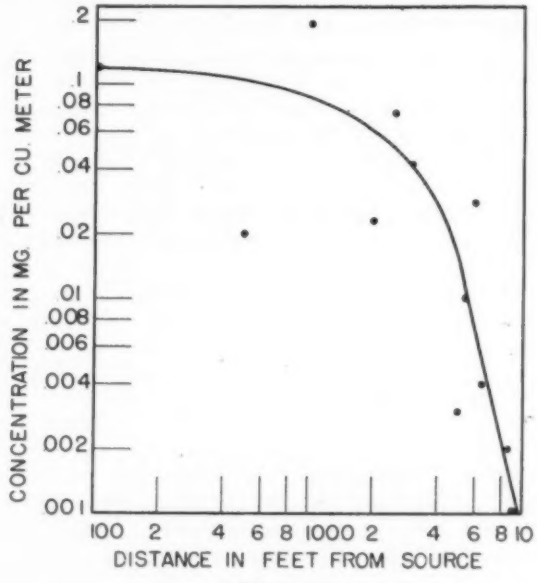

Fig. 2.
Ground level concentration of chromium versus leeward distance from source

Depending upon the distance from the source of pollution, 60 to 720 cubic feet of contaminated air were then drawn through a 5⅞-inch diameter Eaton & Dikeman 623-026 filter paper[2] at a rate of four cubic feet per minute. The weight of chromium obtained on the paper was then determined polarographically[8] and the concentration calculated. At the conclusion of each sampling day the equipment was taken to a distant point upwind of the plant and a blank specimen obtained and analyzed in an identical manner. The value of the blank was then applied as a correction to each of the downwind samples collected on that day.

The atmospheric samples were obtained during daylight hours and fair weather from June 1, to December 16, 1949. The mean leeward concentrations according to distance from the source are shown graphically in Fig. 2.

It may be observed that the concentration decreased gradually from 0.12 mg/m^3 at 100 feet to 0.06 mg/m^3 at 2000 feet. Beyond it dropped rapidly and at 10,000 feet the value obtained (0.001 mg/m^3) approached that of the blanks. The absence of a peak concentration at a dis-

tance of approximately 10 stack heights as reported elsewhere[1,7] is, in all probability, due to the multiplicity of pollution sources which vary from 0 to 78 feet in height.

Orthogonal deviation of the sampling apparatus from the cloud axis, due to shifting wind direction, was experienced. As a result it is believed the values reported are low. Strength of source, wind velocity and cloud diffusion were not measured, hence no adjustments have been applied to the experimentally determined values to compensate for these variables. In the absence, to the authors' knowledge, of previously published information on atmospheric pollution by chromium compounds it is believed the findings reported are of value notwithstanding the limitations enumerated.

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Industrial Health Congress

SAFEGUARDING of the health of the workers will occupy the spotlight at the Eleventh Annual Congress on Industrial Health to be held in the Atlanta Biltmore Hotel, Atlanta, Georgia, February 26-27, 1951. The event will be sponsored by the Council on Industrial Health of the American Medical Association, Chicago, the Medical Association of Georgia, the Fulton County Medical Society of Atlanta, and the DeKalb County Medical Society of Decatur, Georgia. "This will be the first national meeting of its kind in the South," says DR. ANTHONY J. LANZA, of New York, Chairman of the Council on Industrial Health. "It is a recognition of the importance of the South as an industrial area." The two-day session will stress teamwork as the key to successful industrial health services. It also will bring out the interrelation of industry and agriculture. The importance of industrial health in civil defense in times of national disaster will be highlighted in panel discussions. Other panels and round tables will consider the problems which face workers in various lines of industry and will review the efforts being made to find the answers. A panel arranged in cooperation with the Committee on Pesticides of the A.M.A. will discuss the health problems created by new chemicals designed to control pests. One morning will be devoted to a panel on the heart case in industry, to be arranged by the Georgia Heart Association. "The meeting will have as speakers and panel discussants leaders in industrial health, professional and non-professional, from all parts of the country," said DR. CARL M. PETERSON, of Chicago, Secretary of the Council on Industrial Health. It will attract medical, industrial, labor, agricultural and welfare leaders. The Council was established in 1938 to assist the medical profession in developing and maintaining a high standard of health in industry.

—A.M.A. Release.

Carpal Injuries

KELLOGG SPEED, M.D., F.A.C.S.,
Chicago

MOST, if not all, railroad surgeons would no doubt agree that their knowledge of and treatment for the common fracture of the lower end of the radius, the most frequently encountered injury near the wrist and the first cousin of carpal fractures, was satisfactory from all standpoints, but that their knowledge of carpal injuries might be less in comparison. Clean-cut interpretation of carpal injuries by roentgenologists, and the adoption of a workable standard of description or clinical classification, have lagged behind the rate of their occurrence and recognition.

Men in railroad service or working in machine shops and factories, and on the road, exposed to the many dangerous chances of hand and wrist injury, even in airplane service, have undergone a large number of carpal injuries. Murray Meekinson, in a year's service in the Air Corps, encountered 110 fractures of the navicular, as enumerated in his report of June 1, 1944. Colonel L. H. McKim, Consulting Surgeon of the Canadian Army, in two years encountered 125 navicular fractures—all healing without a single instance of non-union. Other men have reported smaller groups here and there; the aggregate is quite large. The proportion of these injuries will be maintained for a long time, and fortunately the alert doctor and roentgenologist will now recognize them early and in so doing will treat them successfully.

Anatomical Considerations

THE anatomy of the bones, their encasing ligaments, their articular surfaces and synovial coverings, their range of movements and their all-important blood supply must be understood by the surgeon. Without this knowledge he cannot interpret the roentgenogram of the acute or progressing lesion, the ancient or healing lesion. He cannot define the fracture or accompanying dislocation, and he consequently may be unable to apply the best treatment.

Clinically and anatomically the carpal bones are divided into two principal rows or groups. The *proximal row* contains the os naviculare, the os lunatum and the os triquetrum. The *distal row* comprises the os hamatum, os capitatum, os multangulum majus and minus, and the os pisiforme. The radiocarpal joint is condyloid. "Entering into this joint are the lower end of the radius, the distal surface of the triangular disk and the carpal navicular, lunate and triangular bones which fit into the elliptical and concave surface of the forearm element." The articular surfaces of all these bones are covered with cartilage and the joints are surrounded by strong capsular ligaments strengthened by interlacing dorsal and volar radiocarpal, intercarpal and two lateral ligaments, the radial and ulnar collateral ligaments. Flexor and extensor tendons crossing the carpus, bound by the annular ligaments of the wrist, further strengthen and protect the carpal joints to maintain a powerful attachment of the hand to the forearm.

The *blood supply* comes from smaller terminal volar and dorsal branches of the ulnar and radial arteries and the metacarpal vessels through the attachments of these ligaments of the carpal bones. Blood vessels do not enter the bones on the articular or smooth cartilaginous surfaces. The blood supply is consequently scant and not uniform, but may vary with individuals or the different bones. The navicular has a natural wide variation of its blood supply, both in location and quantity, which may enter as a factor in its healing or necrosis after fracture or injury.

Most radiocarpal motion occurs between the radius and proximal row of carpal bones both in the volar-dorsal axis and in lateral motion. There is much less motion between the two rows of carpal bones at the mid carpal joint and still less at the distal margin or carpometacarpal joint.

Incidence of Injuries of the Carpus

ABOUT one-eighth to one-tenth of all fractures of the wrist, including Colles' fracture, are carpal fractures. In order of occurrence the injuries of the carpal bones are fractures of the navicular in various parts of its body, dislocations of or around the lunate bone, fractures of the lunate, fractures of the navicular plus dislocations, injuries of the triquetrum and complicated fracture dislocations involving the proximal row and the midcarpal and radiocarpal joints. Isolated fractures or dislocations of or around the bones of the distal row are quite rare but must be looked for in the roentgenogram after hand or wrist injury.

Etiology

THE cause of a carpal injury is usually a fall on the out-stretched hand such as causes Colles' fracture. In the face of definite fracture of the radius and its demonstration by roentgenogram, the surgeon may easily overlook an accompanying injury of the carpal bones. This is particularly so because the first film made soon after the accident may fail to show a definite plane or line of fracture across the injured carpal bone, as has been observed in many injuries of the navicular. The cause may be a *minor blow* or even a *twist of the wrist*, under pressure or

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strain: it may be forgotten by the recipient. Later symptoms and findings bring out the pain and disability of real bone injury, and the roentgenogram finally shows the fracture plane or the resulting change of density of fragments after aseptic necrosis, usually resulting from interfered-with blood supply and enforced use or lack of rest and splintage.

Minor injuries of the carpus must consequently receive careful and complete physical and x-ray examination at the time of injury. They may profitably, in the face of real complaint of pain or local tenderness, be put at rest on a splint with the hand in neutral position, followed by reexamination after one or two weeks by roentgenogram for delayed appearing planes of fracture, even when no primary fracture or separation of fragments is found. Evidence of necrosis of parts of the bone involved resulting from changed vascular supply, as betrayed by changes in density compared to neighboring bones, must be searched for in the roentgenogram. The navicular is the worst offender in this class of injury, because it is the most frequently injured carpal bone, because it has the greatest range of movement in the carpus, because its blood supply is the most variable and its anatomical situation is such that it is subject to the greatest strain and compressions.

Direct violence from blows on the wrist may likewise cause these injuries, often without open wounds.

Direct violence from a fall or blow on the wrist may lead to a mere crack across the bone involved—most often the navicular—with resulting pain which may interfere with functional use of the hand and yet may fail immediately afterward to show displacement of fragments, comminution or compression, or, most unfortunately, even the finest plane of fracture in the first roentgenogram taken at the time of accident. Sometimes this plane is so faint, so indefinite, that it is considered by both roentgenologist and doctor as a normal marking of the bone and is, at least temporarily, not recognized for its true worth. Compression or twist violence or fall may not cause separation of fragments. They frequently, however, interfere with the continuity of the bone surface; both cortical and internal cancellous bone may be cut off from its precarious blood supply to terminate in local aseptic necrosis, with slight bone absorption and ultimate appearance of a fracture line or plane seven to 14 days later. When separation, impaction or comminution is caused at the time of fracture, roentgenologic recognition is not so difficult and is seldom overlooked.

These results are observed mainly in the navicular; they may appear in any of the proximal row of bones; they may even be seen in the distal row of bones where the condition may develop very slowly. The lunate often suffers compressions, early unrecognized, only to undergo late aseptic necrosis with increased bone density as compared to surrounding bones seen in the roentgenogram. The day or incident of the causative trauma may be forgotten. One may be able to determine from the depth of the increased density of the bone, from the reaction of surrounding bones displayed by new bone formation or natural effort at fixation of the intercarpal joints by osseus outgrowth, or by shrinkage and collapse of the individual bone and the reaction of the wrist by pain, fixation and atrophy of soft structures, just how ancient such a condition may be. The injured person may then justly be entitled to consideration of injury forgotten or overlooked both by himself and his doctor.

Pure dislocations, which almost always involve the lunate, or the *fracture-dislocations*, which may involve the proximal half of the navicular and all the lunate, are difficult to read in the roentgenogram. These two pieces may be dislocated out of the radio-carpal joint or retained there. If retained in normal relationship with the distal articular surface of the radius, they may be accompanied by dislocation of all the rest of the hand and carpus around the two portions mentioned, either dorsally onto the top of the wrist or in volar direction into the palm of the hand. They may cause great pain, swelling, stiffness and gross loss of function of the hand and immediate complications from nerve involvement (median). There are local hemorrhage, tearing of ligaments, and finally extensive bone necrosis from interference with circulation unless reduction is made or misplaced bone is removed to permit normal blood flow over intact avenues.

Diagnosis

THE symptoms of carpal fracture may be slight or lacking. An injured individual may never report for professional examination unless working under control and ordered to do so even for sprained wrists. When a man appears after carpal injury the physical examination should be painstaking and thorough, with both arms fully bared for viewing and comparison of range of motion in the wrist joints. The patient should sit with hands comfortably out-stretched on a clean surface. The range of wrist motions, *without movements of the forearm, arm or shoulders*, should be tested and compared in all directions. *Local tenderness* over the proximal row of carpal bones, and then over the distal, should be searched for. The anatomical snuff box should be tested by the tip of the examiner's index finger or the dull end of a pencil with the patient's thumb held outstretched. Tenderness here leads to suspicion of navicular injury. All swelling, over-thickness, lessened range of motion in the wrist, and numbness in the fingers, especially in the distribution of the median nerve, should be noted and recorded. The examination should be gentle and serious; no rough manipulation should be allowed. All findings should be recorded in

writing after comparing the injured with the uninjured wrist.

A roentgenogram should be made in at least two planes with the center ray directly over the radiocarpal joint. The lateral view should pose the forearm so that the shadows of the two forearm bones overlap exactly, thus giving a clear shadow study of the usual relationship between capitate, navicular and lunate in the carpus. If any other bone than the navicular is suspected of injury, additional oblique films may be required to throw into clear profile view the shadow of the bone suspected of injury. Don't be satisfied with any film which does not give clear definition of the bone believed to be injured. Study the film carefully and methodically. It takes much practice to learn to read carpal films.

If a fracture plane in the navicular (most common injury) is not seen, if no dislocation of carpal elements is found, do not dismiss the patient too easily. Apply splint support extending from elbow to base of fingers and have the patient return in a week or 10 days for another roentgen examination. This must always be done if any pain or disability persists, and is the best plan for all patients who sustain carpal injury.

Treatment

TREATMENT of carpal injuries must be based on all the knowledge obtainable by the examination, an inquiry into the exact cause and nature of the injury, a mental review of the anatomy and pathology and an interpretation of the roentgenologic findings.

Treatment of Open Wounds. Immediate treatment after diagnosis of fracture or fracture-dislocation depends on the nature of the lesion. If an *open wound* exists, it must be surgically cleansed and debrided, even if it is but skin deep. If there is a deeper laceration with joints opened into and possible nerve or blood vessel injury, the surgical care becomes a *major procedure.* It should not be attempted in any other surroundings than a properly prepared operating room. To minimize loss of tissue, unnecessary extension of wounds, loss of blood and in-carrying of additional infection from unwise sponging or manipulation, and to render the repair as anatomically perfect as possible, the operation must be performed under general anesthesia and with the use of a constrictor on the arm to ensure a bloodless field. During the repair of soft parts injury and exposure of the carpal joints and bones, a complete reduction of the fracture, its fixation if required, or a reduction of the fracture-dislocation under direct vision in an open wound may be possible. This may entail the use of a strong traction by assistants on fingers or hand, counter traction on the forearm, and manipulation. If instrumental aid is required to assist in open reduction of displaced fragments, this help must be of the most gentle character to avoid injury of the cartilaginous joint surface of any bones or jeopardizing further the already interfered-with blood supply by tearing or stretching of ligaments. The highest degree of preparation of an aseptic field and maintenance of aseptic technic in the operation must be obtained. After reduction the use of antibiotic drugs may be indicated as in any open wounds or fracture according to the nature of the wound, its soiling, or the surgeon's practice. Hemostasis must be secured by minimal ligation, nerves should be approximated and sutured if possible, and severed tendons may be identified but not always primarily sutured, depending on the surgeon's ability and soiled nature of the wound.

Dressing and Splinting. The wound is dressed, either with loose petrolatum gauze pack or as a finished closed debridement. The hand, wrist and forearm are splinted with moulded plaster of Paris strips laid on dorsal and volar surface, over adequate wound dressings, in a neutral position or one demanded to maintain reduction by the character of the fracture or fracture-dislocation. Wound dressing is performed as infrequently as possible. Each dressing may require removal of splintage, in which case there must be adequate help to hold the hand and forearm in quiet position. If the wound remains aseptic, the length of time for immobilization will equal or exceed by 50% that required for the healing of the ordinary closed lesion.

If there is no open wound and no fracture or fracture-dislocation verified by the examination and the roentgenogram, if there is evidence of local tenderness, interference with function and complaint of pain, the hand and wrist must be immobilized on either a padded splint or in a moulded plaster of Paris splint. If the navicular is suspected of injury, the splint must extend from the metacarpal-phalangeal joint to just below the elbow with the hand in a straight position. The thumb should be partly abducted, fully extended and immobilized nearly to the tip, which may be left exposed to observe the circulation. After seven to 10 days a second roentgenogram may be made through the plaster without its removal. Developing planes of absorption or definite fracture often appear plainly through the encasing splint. If they are found, the splint, not having been removed, does not have to be replaced, thus gaining the advantage of not moving the fragments after their first fixation in the plaster. The time elapsed since the injury was first splinted can then be added to the total number of days required for complete immobilization of the wrist.

Fracture of the Navicular. As soon as a diagnosis is made of fracture of the navicular, a closed and isolated injury, immobilization in plaster of Paris must be employed. From a pathologic standpoint fractures of this bone may be divided into several groups. The first classification is recent or ancient fracture. The second is according to the type of bone injury depending on whether the lesion is fracture of the tubercle, ordinary transverse fracture, usually seen near

the center of the bone, comminuted fracture which may involve the whole body or simply one of the fragments of it, proximal or distal to a transverse dividing plane through the bone. *Impacted fracture*, usually through the body, is still another type. This results in impaction of the distal fragment into the proximal along a rough irregular plane with some axial deviation of the distal portion and longitudinal splitting of the bone, which is rare. Some transverse fractures are near the proximal end of the bone and lead to early necrosis of the proximal fragment, which is thus quite completely cut off from arterial blood supply via the small nutrient arteries and devoid of periosteal blood supply because the fragment lies almost completely free from ligamentous attachment in a loose intra-articular position.

Fracture of the tubercle with adequate natural blood supply via ligamentous avenues usually heals rapidly in two to four weeks, without definite immobilization but with restriction in use. During the healing period roentgenologic control is used to show proof of bony union and to confirm continued full use of the hand.

Whichever type of fracture of the body of the bone may be present, it is doubtful that local pressure or manipulation may change the angle or approximate the surfaces more evenly unless a dislocation exists. If fragments are dislocated as in fracture-dislocation, a manipulative effort under anesthesia is indicated to restore approximation. Any rough manipulation or undue pressure may add to interference with local circulation and increase the time required to restore it and to establish bony union. Consequently the hand and forearm are gently cleansed, washed with alcohol, covered with stockinette (including the thumb in added small stockinette cover) and held in neutral position by a reasonably heavy plaster of Paris circular dressing from the elbow to finger bases. A sling may be used to carry the forearm during the first few days after splinting until the plaster has hardened and any edema in the hand is absorbed. I find it advantageous to pad the ulnar styloid with a small piece of felt to avoid later developing painful pressure. A quite heavy plaster is indicated because the patient may return at once to work or other activity and not carry the forearm in a sling. The patient may use and move the arm and fingers where free, thus avoiding muscular atrophy and diminished circulation in the arm as a whole. Likewise the arm thus used is subject to innumerable jolts and blows daily which may indent or break the plaster and lead to replacement long before the surgeon wishes to remove it or x-ray the bone for progress in healing.

For young vigorous adults and adolescents this plaster dressing must remain undisturbed from six to 10 weeks if it can be made to last that long. To remove the plaster encasement, it is cut along the radial side and out along the thumb portion so that it may be slipped off, after spreading *without moving the wrist*. Immediate roentgenogram is then made to inquire into the amount of bone healing. When bone healing takes place rapidly, the fracture plane as such may be obliterated in six to 10 weeks. The hiatus, if any, at the site of fracture will be filled with calcified osteoid tissue. In six or 10 weeks this will probably not be mature and organized into well-defined bony trabeculae similar to the markings found in the body of the bone, but it may represent a clinical union on its way to maturity provided the wrist is not mistreated by overuse. If such a condition of plastic union is found, the splint may be left off, the patient advised to start use gradually and gently, and to spend time massaging finger joints, exercising the hand by squeezing a suitably-sized ball, but not by forcing wrist motion. I believe too hot applications or soaking of the hand and wrist, exercise an untoward action on the further rebuilding and maturing of this still untrabecularized bone. Gentle steady active use by the patient—nothing forced or strongly manipulative—is indicated. Within a month a second roentgenogram should show further maturity of the bone, any local soreness should have disappeared, and the function of the wrist and hand should be much improved. If this is *not* found and there is evidence of absorption of osteoid tissue about the fracture plane or planes, the hand and wrist should again be immobilized as before. It is far better to give an apparently too long immobilization than a too short one.

If after removal of the plaster as outlined, the fracture appears not united, it should be replaced in a circular plaster of Paris dressing at once *without movement or any manipulation*. This second plaster dressing should be worn an additional period of six weeks and reinvestigated by x-ray. Several such plaster dressings may be needed to obtain a final bony union, proved by x-ray examination and verified by painless increasing range of motion and functional use. Don't despair too quickly—some patients require as long as 10 to 14 months of such treatment.

Dislocation. If fracture-dislocation is present, is diagnosed, and is understood in the displacement of its various components, the surgeon must make every effort, in the recent injury, to effect manipulative reduction. This can only be obtained under full anesthesia and with sufficient assistance, especially in the case of manual laborers who have powerful wrists and forearms. The patient is rendered completely lax by the anesthesia. The shoulder of the affected arm is partially abducted and the arm is held by an assistant in that position, grasping *firmly* with both hands with his feet well planted on a non-skidding floor, as far out of the operator's way as possible. Two assistants may be helpful—one on the opposite side of the table from the operator.

Depending on the type of dislocation, whether dorsal or volar, the operator then plans his

manipulation. The first step is a *prolonged traction on the hand,* while assistants make counter traction on the arm. Traction is maintained in the opposite direction to the dislocation, e.g., in volar dislocation of capitate and other distal row bones, the pull is slightly upward and in full extension. This must be kept up several minutes and, during its course, the bones may be felt sliding into place. If not successful at first, it must be repeated and can be helped by the pressure from the thumbs of an assistant against the over-riding bulging mass of bone at the dislocation site on whichever side of the carpus the bulge exists. Prolonged effort and much strength, smoothly and persistently applied along with deep anesthesia, will usually effect reduction, after which x-ray films are made at once and the forearm, wrist and hand put in a plaster dressing as described for simple fracture. Some care has to be taken of the amount of swelling; the radial pulse must be certified; the sensation and movement of the fingers checked, and the condition recorded in writing as soon as anesthesia passes off. The length of time of immobilization must be gauged by the fracture more than the dislocation. Bony union must be obtained before use and movement are started; if not, one may end up with a reduced dislocation but with an un-united bone.

If manipulative reduction does not succeed under anesthesia, I believe it is best to desist for a while, to cleanse hand and wrist and encase in a sterile dressing or towel, elevating the hand on a pillow for a short time. If no bullae appear, another x-ray check may be permitted, and plans made for operative reduction or excision of bone fragments. Don't be in too much of a hurry. Be sure the skin is clean and can be rendered aseptic for what may prove to be a longer and harder operation than is believed possible.

The navicular and lunate take the longest time to heal after fracture-dislocation. I have had successful unions in the triquetrum in eight weeks in two cases. The pisiform often requires 10 weeks immobilization.

Ancient Fractures

ANCIENT fracture may be diagnosed when the patient is seen late—several weeks after injury—when there have been inadequate efforts at immobilization, or none at all, or when the injury has been called a sprain, or been unrecognized or not even seen by a surgeon. The symptoms of pain, local tenderness, restricted wrist motion, slight deformity and functional interference persist in a varying degree—some not unpleasantly, others in great intensity. There may be evidence of nerve injury, especially in the median or its branches. The roentgenogram shows a spreading area of necrosis around the fracture plane, cystic absorption of much of the body of the bone (especially the navicular) or fragmentation, increased density as compared to its neighbors, and sometimes new bone formation extending from adjacent bones into the joint areas about the fractured bone. Some patients appear five to 10 years after fracture with marked cystic changes in the interior of the bone and increased density of the partially dead and partially healed cortex.

Treatment. Some ancient fractures, even with the advanced pathologic changes suggested, may yield to *prolonged immobilization* as described. The fracture dislocations will not yield because much of the functional disability in them is mechanical, as in an unreduced dislocation at any joint (e.g., elbow). These require well planned *excision of bone,* freeing enough space to permit some hope of recurring motion when the muscles moving the joints become re-educated. Such excision of bone should attempt to stick to old joint lines and leave intact cartilage behind.

For instance, in a transnavicular perilunar dislocation, ancient and unreduced, the indication would be to perform a carpalectomy—a removal of at least two of the proximal row carpal bones, namely lunate and navicular, *including the navicular fragment adherent to the distal displaced row,* and closing the wrist with subsequent early motion and muscle training. This operation must be done without adding any injury to bones, cartilaginous surfaces of adjacent joint, nerves and tendons in the area opened. It can only be done under general anesthesia, under a constrictor, with suitable instruments, and with adequate anatomical knowledge of just what structures are being excised. I have seen surgeons make anatomical errors in these excisions. In some instances the triquetrum must also be excised along with the other two bones mentioned. After excision of the proximal row of carpal bones the capitate retracts to the articular surface of the radius, a new joint motion is obtained between capitate and radius, and a reasonable functional return with an almost undetectable cosmetic shortening of the carpus results. Careful planning of the amount of postoperative splinting, starting of motion and massage must be made in each case.

For the *uncomplicated ancient fracture* (as of the navicular alone) surgeons must have some operative attack when prolonged immobilization is refused or is objectionable from any standpoint. Such methods are (1) complete excision of the offending ununited bone, leaving a hiatus in its place or inserting a replica of vitallium or other metal in the defect; or (2) attempts to overcome the non-union by (a) drilling across the fracture plane, (b) insertion of one or more small bone transplants. In some long-standing cases where the surgeon cannot be sure whether a dislocation may or may not have been a complication, a fusion of the radio-carpal joint may be the way out to relieve pain, to strengthen the joint, and ultimately to increase the functional use even in the face of the permanently stiffened articulation.

Complete excision of the offending bone is frequently done for *irreducible dislocations of the lunate*, some of which may not be so ancient. The carpus seems to get along quite well without this bone. Incision is made on either dorsal or volar surface of the wrist under anesthesia and constrictor, and no structures in the wrist should be damaged. All tendons, nerves, etc., should be gently retracted. The annular ligament may be cut but must be resutured and the articular surfaces of the remaining bones must not be damaged. Tight closure and little if any splinting are required after this relatively simple excision of the lunate alone.

Excision of the proximal row of carpal bones is much more difficult, especially when one has to find and bring out the distal fragment of the fractured navicular, which clings to the distal row. It is an operation of major difficulty and the instructions given for all such operations must be followed.

For excision and fusion of the radiocarpal joint I prefer an approach on the ulnar side of the wrist, partial excision of the lower end of the ulna and a block of bone thus obtained tucked into the freshened bone area to be fused. This is followed by plaster of Paris splinting.

Ancient or ununited fractures of bones which one hopes to retain as viable tissue and to treat by operation may be drilled through a small opening in the anatomical snuffbox at the base of the thumb for the navicular as an example, using x-ray control at the operating table to be sure of the direction and extent of insertion of the drill. Long immobilization in plaster is required with the same criteria for establishing union as after nonoperative treatment. This method I have used successfully many times; it is simple and is apparently highly efficient.

Bone Transplants. Bone transplants have also been used to obtain union in ununited carpal bones (navicular). The transplant may be inserted in a prepared bed in the bone after exposure by a dorsal approach, or it may be inserted through drill holes made via the snuffbox. The first-named method is a little grosser, and may interfere further with the blood supply of the bone. Operation via the snuffbox is delicate, but quite sure, and no interference with the vascular supply of the navicular need follow. Both methods require the usual subsequent prolonged immobilization. The functional results may not be forthcoming for one or two years after operation and then may not be up to the patient's expectation, yet the pain and other symptoms may be absent.

Metallic Insertions. Recently Captain Waugh has made some vitallium replicas of the carpal navicular to be inserted in the site of ancient fractures after removal of the entire fractured navicular bone. Only a few instances of this substitution have as yet been done in man. It may offer a quick way out for the comminuted fracture, for the complicated fracture-dislocation, and the non-united or ancient fracture with or without cavitation in the bone. My feeling is that with the small amount of range of motion in the radiocarpal joint no analogy can be drawn with arthroplasty of the hip and the result following the insertion of a vitallium cap on the head of the femur in the wide normal excursion of the hip joint. I have examined some of the patients thus operated upon after carpal injury by means of vitallium substitution. In most there was restricted wrist motion but not much pain.

(122 South Michigan Ave.)

Offer to Help

THE Board of Regents of the American College of Surgeons has sent a statement concerning the drafting of doctors, drawn up by a special committee appointed by DR. FREDERICK A. COLLER, chairman of the College's committee on graduate training in surgery, to the President and 11 other top officials. The statement, signed by DRS. B. NOLAND CARTER, of Cincinnati, LOYAL DAVIS, of Chicago, PAUL B. MAGNUSON, of Washington, PHILIP D. WILSON, of New York, and EVARTS A. GRAHAM, of St. Louis, is summarized as follows: (1) The American College of Surgeons offers its assistance to the national government in the present emergency mobilization of the armed forces. (2) The American College of Surgeons urges that everything possible be done to conserve medical man power during the present emergency. To avoid wastage, three recommendations are made: (a) Effective unification of the medical services of the armed forces. (b) When possible the use of part-time civilian doctors in some manner similar to that successfully employed by the Veterans Administration. (c) Prompt utilization of Veterans Administration facilities for the care of those patients whose condition is such as to preclude eventual return to military duty. (3) To avoid the disruption of the training programs in the teaching hospitals, which would have disastrous consequences on both the armed forces and the country as a whole, careful screening should be used in inducting into the armed forces those doctors who are undergoing training. (4) The American College of Surgeons, because of its years of experience in surgical training, can well serve the government through representation on those advisory boards or commissions concerned with medical officer procurement.

Care of Hand Injuries

Prepared by
American Society for Surgery of the Hand

Principles of Early Management

PROTECTION OF THE HAND: Following injury, the hand is particularly susceptible to the development of complications leading to serious disabilities. For this reason it is important that the freshly injured hand be given the most careful protection against such complications as result from added infection, additional tissue damage and stiffening.

The principles governing the provision of this protection may be briefly stated as follows:

A. *Protection against added infection:* Any open accidental wound of the hand may be assumed to be contaminated. It is important that no additional infection be added. This requires: (1) Protection of the wound at once with a sterile dressing. (2) Avoidance of putting anything into the wound, such as instruments, gauze, applicators, sponges or any sort of antiseptic. (3) If any cleansing of the areas around the covered wound is done, it should be with soap and water only. (4) Avoidance of all efforts at treatment of the wound by exploration, debridement or repair of damaged structures until adequate facilities are available. Adequate facilities for this purpose should include a location where surgically aseptic technique is employed, adequate anesthesia, proper instruments, sufficient assistance, good lighting and the provision of a bloodless operative field. (5) Application of a sterile dressing which will protect against the entrance of foreign material. Such a dressing should be voluminous, firmly applied with moderate pressure, separating the fingers from each other, and should maintain the hand and fingers in the position of function. (6) Antibiotic drugs should be administered systematically, not locally, in full dosage. Tetanus antitoxin (or toxoid) should be administered when the conditions warrant.

B. *Protection against added tissue damage and deformity:* Immobilization of the hand is required in any major injury, whether the wound involves skin, tendons, nerves, joints or bones. Immobilization should be governed by the following principles: (1) Immobilization should be employed as soon as possible after receipt of the injury for protection from further tissue damage. (2) Following definitive treatment of the injury, the immobilization should be continued as long as may be required for healing to occur. (3) Immobilization should be in the position of function (position of grasp) in order to maintain optimum relation of bone fragments and soft tissue structures. (4) The position of function in immobilization is necessary to prevent disabling deformities, contractures, muscle weakness and joint stiffening, and to insure the earliest return to usefulness after healing. (5) Flat splinting of the hand or any of its digits must be avoided at all times.

Early Definitive Treatment

THE FIRST-AID TREATMENT of hand injuries is directed fundamentally at protection. It should provide protection from infection, from added injury, and from future disability and deformity. This protection is afforded by non-interference with the wound, cleanliness of surrounding areas, the application of sterile protective dressings and immobilization in the position of function. The general requirements for proper early definitive care are:

A. *Thorough evaluation of the injury:*

1. Determination of the time, place, causative agent and mechanism of the injury.
2. Determination of the nature and extent of the first treatment given.
3. Determination of infection status: whether the wound is relatively clean, grossly contaminated or with infection established.
4. General nature of the wound, i.e., contusion, abrasion, burn, incised wound, lacerated wound, crushing wound, puncture wound, tooth wound, imbedded foreign body, fracture, compound fracture, amputation, or combined injuries.
5. Evaluation of structural damage: (a) Degree and extent of surface injury. (b) Source of major bleeding. (c) Evidence of tendon or muscle damage by testing function *against resistance.* (d) Evidence of nerve injury elicited by testing for motor and *sensory* functions. (e) Bone and joint injury determined by x-ray. (f) Discovery and exact localization by x-ray of suspected opaque foreign bodies.

B. *Adequate facilities and equipment:*

1. Each hospital or clinic should have at least one surgeon who is thoroughly familiar with the anatomy and physiology of the hand and who is prepared to undertake the early treatment of its major injuries.
2. Such treatment should be rendered under strictly aseptic conditions, preferably in an operating room, with careful adherence to aseptic technique in the matter of scrubbing, draping, masking and the use of gloves.
3. An adequate supply of appropriate instruments.
4. Sufficient assistance to assure good exposure.
5. Good lighting.
6. Provision of a bloodless field by means of pneumatic tourniquet or blood pressure cuff.
7. Complete anesthesia for the patient, preferably by general anesthesia.

C. *Application of appropriate treatment:*

1. Thorough cleansing of a wide area around the wound with the wound protected (entire hand and forearm). Shaving, soap and water scrub.
2. Thorough cleansing of the immediate wound area, preferably with soap and water or a bland detergent. Antiseptics should not be used in or on the wound.
3. Careful inspection of the wound and assurance of adequate exposure, by additional incision if

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This material on the "Care of Hand Injuries" was prepared by the American Society for the Surgery of the Hand, and distributed by the Committee on Trauma of the American College of Surgeons through its Regional Committees. There were six articles in the series. They are published here under their respective headings without numerical designation.

it is necessary, *closely paralleling natural creases.*

4. Thorough toilet of the wound, removing, under inspection, all foreign matter. Excision, by sharp and careful dissection, of all completely devitalized or grossly soiled tissue in the wound surfaces. It is essential that the greatest care be exercised to spare all tissues that may be viable, particularly skin, tendon, nerve and bone fragments.

5. Assurance of hemostasis by ligation of major injured vessels.

6. Repair of injured nerves by end-to-end union with fine interrupted perineural sutures. The uniting of divided digital nerves is important to future function.

7. Repair of other soft tissue injuries, where appropriate, i.e., in clean wounds of short duration, in well-cleaned contaminated wounds of not over eight hours' duration, never in wounds with established infection.

8. Reduction of fractures and dislocations, and retention in corrected position by traction or splinting in the position of function (position of grasp with wrist in dorsi-flexion).

9. Application of protective dressing, fingers separated by gauze and hand immobilized to such extent as may be necessary to permit healing, in the position of function (never in the flat position).

10. Administration of antibiotics and protective antitoxin as indicated.

D. *After-treatment:*

1. Elevation and rest of the hand.

2. Non-interference with initial dressing for a sufficient time to permit healing, unless evidences of suppuration develop.

3. Restoration of skin coverage of denuded areas at earliest possible time. Partial thickness skin grafting is a simple and valuable means of promoting early healing.

4. Early restoration of function for non-affected parts of the hand by directed *active* motion to the fullest extent that will not jeopardize healing of repaired structures.

5. Restoration of function in affected parts of the hand by directed *active* motion as early as is consistent with full healing and preservation of the repair of damaged structures.

Surface Injuries

THE FIRST-AID CARE of wounds of the hand is directed fundamentally at protection. It should provide protection from infection, from added injury, and from future disability and deformity. The best first-aid management consists in the application of a sterile protective dressing, a firm compression bandage and immobilization by splinting in the position of function.[1]

No attempt should be made to examine, cleanse, or treat the wound until operating room facilities are available.

Early definitive care requires thorough evaluation of the injury with respect to its cause, time of occurrence, status as regards infection, nature of first-aid treatment and appraisal of structural damage. For undertaking the definitive treatment the conditions required are a well-equipped operating room, good lighting, adequate instruments, sufficient assistance, complete anesthesia and a bloodless field. The treatment itself consists of aseptic cleansing of the wound, removal of devitalized tissue and foreign material (exercising strict conservation of all viable tissue), complete hemostasis, and the repair of injured structures, to be followed by protective dressing to maintain the optimum position. After-treatment consists of protection, rest and evaluation during healing and early restoration of function by directed active motion.

Burns, abrasions and avulsions may cause destruction and denudation of any area of the skin of the hand. The care of such injuries has three major objectives: protection from infection; early restoration of skin covering; and avoidance of disabling scarring and contractures. These objectives are sought in the various stages of treatment.

A. *First-aid treatment:* (1) Chemical burns: Remove chemical by profuse irrigation with water, preferably warm. (2) Heat burns, abrasions and chemical burns (after washing away the injuring agent): Apply sterile dressing completely to cover the hand and bandage firmly.

B. *Definitive treatment:* This should be carried on in operating room under conditions of strict asepsis (draping of field, sterile gloves, masking of operator and attendants): (1) Gentle removal of first-aid dressing, soaking loose with normal saline solution if necessary. (2) Gentle cleansing of injured surface by light sponging with saline on cotton balls. If surface is dirty or greasy, it may be gently cleansed with sterile neutral soap in sterile water or bland detergent. Loose fragments and tags of skin are removed. Blisters are not opened. (3) Sterile strips of fine-mesh vaseline-impregnated gauze are smoothly applied to the injured surface. These are covered with dry sterile gauze, gauze being placed between adjacent fingers. The whole hand is covered with a thick layer of sterile mechanic's waste or fluff gauze, and splinted in the position of function. Elastic knit bandage is applied over all, including all fingers, with firm even pressure. The hand is kept elevated.

C. *Subsequent dressings:* The original dressing is left undisturbed for 12-14 days unless elevation of temperature suggests active infection requiring inspection. The second, and all subsequent dressings until healing, are done under completely aseptic conditions (as described above). Preparations for skin grafting should be made in advance: (1) The dressing is removed. Slough and debris are washed away by irrigation with normal saline solution (no scrubbing of surface). (2) Granulating areas from which slough has separated should be covered with thin split-thickness skin grafts. (3) Dressing, similar to that employed at first definitive treatment is applied. Hand is splinted in position of function. (4) Further dressings, similarly conducted, are done at intervals of seven days until epithelization of burned surface is complete. Skin coverage by grafting should be secured as rapidly as possible, as the best assurance against infection, inflammation, infiltration, scarring and contractures. This early coverage by "skin dressing" is of the greatest importance, even when epithelization from the margins is proceeding satisfactorily. Split-thickness grafts are best for this purpose, even though it is anticipated that some of grafted area must later be removed for replacement by more suitable skin.

D. *Restoration of function:* As soon as epithelization of burned surfaces is complete, directed active use and exercise of the hand are begun. Normal use

1. Position of function or position of grasp: wrist hyperextended in cock-up position; fingers in mid-flexion and separated; thumb abducted and in mid-flexion, with tip pointing toward little finger.

of the hand is encouraged and voluntary exercises and appropriate occupational therapy prescribed.

Lacerated Wounds

LACERATIONS may damage skin, fat, fascia, muscles, tendons, tendon sheaths, blood vessels, nerves and, more rarely, joint or bone. Objectives in the treatment of such injuries are protection from infection; restoration of structures; avoidance of deformity; and early restoration of function.

These objectives are furthered by proper first-aid care, and definitive treatment as outlined above.

A. *Definitive Treatment:* To be undertaken only under the proper conditions and according to the principles outlined for early definitive treatment.

1. Examination of the hand to determine: (a) Location and extent of the wound. (b) Source of major bleeding. (c) Presence of foreign material. (d) Function of tendons, to be tested *against resistance.* (e) Function of intrinsic muscles. (f) Condition of nerves as regards both sensory and motor functions. (g) Integrity of bone and joint.

2. Anesthetization of the patient and application of hemostatic blood pressure cuff (not to be inflated above 300 mm.).

3. Thorough cleansing of wound region and then of entire hand and forearm with soap and water or bland detergent.

4. Removal of foreign material from the wound.

5. Careful, gentle, thorough, but conservative excision of devitalized tissues, sparing all structures that may survive.

6. Repeated cleansing of wound by irrigation with warm normal saline solution.

7. Securing and ligation of divided blood vessels.

8. Repairing damaged structures in appropriate cases. Proper wounds for this repair are: those in which infection has not become established; those not grossly contaminated by highly infective material; relatively clean wounds not more than three or four hours old. In general, wounds not fulfilling these criteria are better left unrepaired to await secondary closure and later reconstructive surgery. They should, nevertheless, be as carefully cleansed of foreign matter and dead tissue as are those prepared for primary closure. In such cases severed nerve ends may be identified with non-absorbable sutures or lightly united.

(a) Nerves: (1) All severed nerves should be repaired, including the digital nerves. (2) Fine arterial silk on fine needles should be used, accurately approximating the nerve ends by small interrupted sutures placed around the periphery. These sutures should include only the perineurium, not the nerve bundles. It is important to avoid axial rotation, particularly in nerves having both motor and sensory function. (3) Nerves are to be distinguished from tendons, especially at the wrist, by their anatomical position, softer texture, pinker color, small surface capillaries, and distinct nerve bundles seen on cut ends. Pulling on a nerve will not flex a finger. (4) Nerves should be handled gently, never crushed, rubbed, or allowed to become dry.

(b) Tendons: (1) All severed tendons should be repaired, including the tendons of intrinsic muscles. An important exception to this rule concerns flexor tendons severed within the flexor sheath or in the digital flexor canal. Primary suturing of the flexor profundus in this location rarely succeeds in restoring useful function even if the flexor sublimis is removed. Suturing both flexor sublimis and profundus in this area almost invariably results in failure. Should even minor infection occur, failure is assured. With rare exceptions, it is sound practice to repair the skin and digital nerves only, leaving the flexor tendons for secondary reconstruction when severed in this region. (2) Non-absorbable sutures of silk or wire are used accurately to approximate the severed tendon ends after they have been cleanly squared off with a sharp knife. (3) Additional incisions to secure retracted tendon ends should follow flexion creases. They should be curved or transverse, never longitudinal, and never in the palmar or dorsal midline of a finger. (4) Tendons should be handled gently; never crushed, rubbed, or allowed to become dry.

(c) Muscle: (1) Severed muscles should be lightly approximated with interrupted mattress sutures, avoiding tension and constriction. (2) Muscle thus repaired should be alive, contractile and vascular, all devitalized shreds being trimmed away. Following these procedures, the hemostatic blood pressure cuff is released to permit identification, control and ligation of bleeding vessels. The field should be dry before closure of the wound. (3) Fascia: Severed fascial and ligamentous tissue should be repaired with interrupted mattress sutures, avoiding tension. (4) Subcutaneous tissue: Subcutaneous fatty tissue may be lightly approximated with interrupted fine sutures. (5) Skin: The skin should be closed with fine, non-absorbable sutures. (6) Dressing: Firm pressure dressing is applied, the fingers being separated, with gauze between them. The hand is immobilized by splinting in the position of function, except when suture of severed tendons requires splinting in a position to insure the least strain on their suture lines. If nerves have been severed, the position of function is particularly important to prevent deformity due to contracture of active muscles when their opponents are denervated and paralyzed.

B. *Aftercare:*

1. Antibiotics and tetanus antitoxin (or toxoid) are administered systemically as prophylaxis against infection.

2. The extremity is kept elevated for the first three or four days.

3. Dressings are not removed for several days, usually one week, unless infection develops.

4. The healing of severed tendons and nerves requires three weeks of uninterrupted immobilization.

5. When nerves are severed, corrective splinting is necessary until reinnervation of paralyzed muscles has occurred.

6. Restoration of function is best secured, after healing, by directed voluntary exercise and appropriate occupational therapy.

Fractures and Dislocations

A. THE PURPOSES *of treatment of closed fractures and dislocations of the bones of the hand are:*

1. Protection of the injured bony structures from further displacement and avoidance of added damage to soft parts.

2. Restoration of normal relations of the bony structures.

3. Maintenance of the corrected relation of the bones to permit healing, at the same time avoiding stiffening in position of non-function.

4. Restoration of function.

B. *These objectives are sought in the various stages of treatment:*

1. First-aid treatment:

(a) Avoid manipulation or attempts at reduction until skilled attention is available and accurate diagnosis has been made. (b) Prompt protection of the hand by complete immobilization in the position of function pending definitive treatment.

2. Definitive treatment: When proper skill and facilities are available this consists of:

(a) Diagnosis by means of (1) Inspection to determine swelling, ecchymosis, deformity, loss of function. (2) Palpation, gently employed, to discover bony irregularity, point of maximum tenderness, referred pain. This sign is of importance in discovering fractures of the long bones, particularly where deformity may not exist or is concealed by swelling. Gentle pressure in the line of axis of the long bone will result in pain at the fracture site. (3) X-ray examination. Obligatory where fracture or dislocation is suspected. Injuries in the region of the carpus require not only antero-posterior and lateral views but two or more oblique views in addition. Fractures of the carpal bones frequently fail to show in antero-posterior and lateral views.

(b) Reduction. Restoration of normal position of bony structures should be secured at the earliest possible time by: (1) Manipulation. Whether reducing a fracture or a dislocation, full relaxation, preferably under general anesthesia, is desirable. Manual traction, pressure and moulding should be gentle and deliberate to avoid further soft-part injury. When attempts at reduction by manipulation are not promptly successful under these conditions, they should be abandoned in favor of open (operative) replacement. Dislocation at the metacarpophalangeal joint of the thumb will almost invariably require open reduction. (2) Skeletal control. To maintain reduction, particuarly of oblique or comminuted fractures of phalanges or metacarpals or fractures into joints, control by skeletal fixation may be required. This may be applied by means of a length of thin Kirschner wire inserted transversely through the distal end of the fractured bone or through the terminal phalanx of the finger. The hand and injured finger or fingers should be supported in the position of function on a palmar moulded curved form or ball splint. This alone will ordinarily suffice to maintain proper position after reduction by manipulation. When control by skeletal fixation is required for maintenance of reduction, the transfixing wire may be connected to this splint on its palmar aspect or to a projecting frame, at or above wrist level, by elastic bands. Fixation or traction by means of a hole in the finger nail, or by adhesive applied to the finger, or by woven constricting device is not satisfactory. Continued straight traction on the fingers in the extended position is to be avoided. (3) Open reduction. When manipulation fails to produce satisfactory reduction, open operative reduction is to be employed. This requires careful preliminary skin preparation and should be carried out under optimum operating conditions as described in Early Definitive Treatment.

3. Maintenance of reduction.

(a) Immobilization of bony injury following reduction should: (1) Be secured with firm, even pressure bandaging, permitting no motion at site of injury. (2) Be non-constricting, not interfering with circulation. (3) Be comfortable, causing no excess pressure. (4) Preserve, as far as possible, the position of function, taking into account the normal concavities of the palmar surface of the skeletal structures (arches of the hand) and flexor surface curves of the phalanges. (Wrist in 30° dorsiflexion, metacarpophalangeal and distal interphalangeal joints in 45° flexion and middle interphalangeal joint in 90° flexion.) Flat splinting is to be condemned. (5) Leave free to move all joints whose motion will not jeopardize position and healing. During immobilization, active motion of all joints not necessarily confined is to be encouraged.

(b) Immobilization may be accomplished by: (1) Splinting or plaster casting, applied as described in T B Reduction. (2) Internal fixation. Kirschner wires may be employed, following either open or closed reduction, as axial intramedullary splints for individual long bones (not to protrude into a joint); as transversely introduced fixation pins passing through adjacent bones to secure the fragments of metacarpal fractures; as penetrating fixation for fragments of carpal fractures. Wiring or plating of fractures of the bones of the hand is generally unsatisfactory. During the early period of immobilization, elevation of the hand is desirable. Immobilization of the injury should be consistent and continuous until healing and firm union have been established. Healing of ligamentous injuries accompanying dislocations requires two weeks of immobilization following reduction. Healing of fractures of the long bones requires immobilization for three to five weeks. Healing of carpal bone fractures requires 12 to 14 weeks' immobilization. Fractures of the navicular may require four months to unite. If immobilized consistently for this length of time, most of these fractures will not require surgical intervention.

4. Restoration of function: During the healing process, all joints not necessarily immobilized should be freely moved to activate their controlling muscles and their use by the patient encouraged. Following establishment of healing or firm union, restoration of function is secured by directed active motion, particularly through the means of exercise and occupational therapy.

Open Fractures

MAJOR WOUNDS of the hand may be caused by crushing or tearing injuries, injuries from explosions, or by the impact of foreign bodies. Such wounds may involve damage to skin by burning or avulsion, laceration of soft tissues, and open injuries of bones or joints.

A. *Purposes of early treatment are:*

1. Relief of pain and shock.
2. Arrest of hemorrhage.
3. Protection against infection and further injury.
4. Removal of foreign bodies and dead tissue.
5. Conservation and restoration of damaged structures.
6. Early healing.
7. Restoration of function.

B. *Stages of treatment:*

1. First-aid: (a) Application of voluminous sterile dressing without interference with the wound, the hand being placed in the position of function. (b) Hemostatis can usually be obtained by pressure gently applied to such a dressing. A tourniquet is rarely needed, but may be employed briefly to check brisk, continuing blood loss. (c)

Shock and pain may require appropriate treatment. (d) The hand, in initial dressing applied as above, is splinted in position of function for transportation to adequate surgical facilities.

2. Definitive treatment: (a) If bones or joints are thought to be involved, preliminary x-ray views are made without disturbing the initial dressing. (b) Patient is treated systematically for pain, shock and hemorrhage; antibiotics and tetanus antitoxin (or toxoid booster) are administered, and the patient prepared for operation. (c) In operating room, with patient anesthetized, dressing is removed. (d) With the wound carefully protected, the arm, forearm, and hand are scrubbed, shaved and draped. (e) The skin wound and the area about it are carefully and gently cleansed with soap and water or mild detergent (no antiseptics) and the entire wound examined. Bleeding vessels are ligated. (f) Foreign material and devitalized tissue are accurately trimmed away. This procedure aims at thoroughness, but must strictly conserve the maximum of viable tissue. It is particularly important to preserve skin and all bone fragments which are not completely free and displaced. (g) Repair of soft tissue injuries is governed by criteria of length of time since injury and of the degree and nature of contamination. Where conditions are favorable (i.e., in relatively clean wounds not more than three or four hours old), initial repair may be effected within limitations described under "Lacerated Wounds."

Even in unfavorable cases, severed nerves should be united if possible, or at least identified by long sutures of stainless steel. (h) Dislocations of joints, if open in the wound, are reduced. (i) Bone fragments in the open wound are restored as nearly as possible to normal position, but without fixation by foreign material. In some instances the employment of stabilization with a minimum of stainless steel wire is justifiable if required to maintain reduction. (j) Maintenance of reduction of open fractures may usually be obtained by skeletal traction or appropriate splinting. (See "Fractures and Dislocations.") If required, pins for bone fragment fixation or skeletal traction are applied as there described. (k) Maximum skin closure is effected. (See "Lacerated Wounds.") Particular care is taken to cover bones, joints, tendons and nerves. Where required, pedicle skin grafts (local or from abdominal wall) may be used for coverage unless established or inevitable infection forbids. (l) Pressure dressing is applied and the hand splinted as required for optimum control of its repaired injuries, approximating as closely as possible the position of function. (See "Lacerated Wounds" and "Fractures and Dislocations.") Flat splinting is to be avoided. Uninjured parts of the hand should be left free for movement. The hand is kept elevated.

3. Subsequent dressings: These are managed with regard to the following factors named in the order of their importance: (a) Control of infection, adequate drainage; (b) Establishment of bony union and joint healing; (c) Early completion of skin coverage and healing. The establishment of infection in the wound may require early and frequent dressings to insure its control. These should be done under aseptic conditions and in such manner as not to disturb the corrected position of injured bones or joints. Large skin defects should be covered by grafting at the earliest moment compatible with the maintenance of position of corrected bone and joint injuries.

4. Restoration of function: Following healing of skin and soft tissues and firm union of bony structures, as much function as possible should be restored by directed active use of the hand, therapeutic exercises and occupational therapy. Reconstructive surgery is often required after such injuries to permit maximum restoration of function. Reconstruction such as this will be less extensive and less formidable if the early management of the injury is judiciously and carefully carried out.

Industrial Hygiene

WHAT practical role can industrial hygiene play in modern industry? As the term implies, industrial hygiene is concerned with the promotion and maintenance of the health of industrial workers. As a field of professional specialization or inquiry, it is built upon the assumption that the human problems of industry can, in large measure, be translated into technical terms for quantitative study and the subsequent development of specific and practical procedures for supervision and control. One of the primary objectives of industrial hygiene, therefore, is the establishment of factual relationships between the health and well-being of the worker on the one hand and the stresses imposed upon him by his job and by the industrial environment on the other. Industrial hygiene aims to identify and measure these stresses, to describe their effects upon man, in quantitative terms. From such relationships, levels of tolerance can be established which can be used by the engineers in the design of industrial processes, equipment, and buildings. Thus industrial hygiene may contribute to the over-all program of personnel management in the same way that industrial research contributes to production.

—From "The Role of Industrial Hygiene in Modern Industry," by T. F. HATCH, Industrial Hygiene Foundation, Pittsburgh.

Medicine in Industry

— The Ann Arbor "Discussional" on Industrial Health —

University of Michigan School of Public Health
October 27 and 28, 1950

Reported by
Jean Spencer Felton, M.D.

REPRESENTING more than two million of America's industrial workers, the Medical Directors of some 15 companies met in Ann Arbor October 27 and 28, 1950, at the University of Michigan School of Public Health. With the newly coined designation "Discussional," a type of informal gathering took place that allowed an interchange of ideas between the visiting physicians from industry and the faculties of the Schools of Public Health and Medicine. Recent trends in social, political, industrial and general medical relations and in events of international importance have created the need for an objective viewing of industrial health practices in the light of these developments. To that end, therefore, under the General Chairmanship of DR. CLARENCE D. SELBY, Resident Lecturer in Industrial Health, the physician in the plant met with the physician in the University to discuss these matters of current interest: (1) Industrial medical problems resulting from the lengthened expectancy of life. (2) Extent to which industrial physicians should participate in general medical care programs for employees and their families. (3) New opportunities provided for industrial physicians by medical research and the effects of some of the newer drugs and antibiotics. (4) What examinations should executives receive to assist them in the maintenance of their health, and from whom should they obtain them. (5) Civil air defense. (6) Effects of atomic weapons. (7) Atomic medicine. (8) Radiological defense. (9) Present status of graduate education in occupational medicine.

In the Public Health School's comfortable and attractive Third Floor Lounge, DR. HENRY F. VAUGHAN, Dean of the School, was host to the following directors of medicine in industry: DRS. MAX R. BURNELL and EARL F. LUTZ, of General Motors, DR. CAREY P. McCORD, of the Chrysler Corporation, and DR. HARLEY L. KRIEGER, of the Ford Motor Company, representing automobile manufacturing; DR. NELSON W. BOLYARD, of the Standard Oil Company of Indiana, DR. MELVIN N. NEWQUIST, from the Texas Company, and DR. ROBERT C. PAGE, of the Standard Oil Company of New Jersey from the oil production industry; DR. J. M. CARLISLE, of Merck and Company, DR. ALLAN J. FLEMING, of E. I. du Pont de Nemours and Company, and DR. WILLIAM A. SAWYER, of the Eastman Kodak Company, representing chemical production; DR. EDWARD H. CARLETON, of the Inland Steel Company, and DR. MELVILLE H. MANSON of the American Telephone and Telegraph Company, from steel and communications; DR. JOSEPH H. CHIVERS, of the Crane Company, and DR. CHARLES-FRANCIS LONG, of Bayuk Cigars, Incorporated, representing, as it were, necessity and luxury; while the odd product of atomic energy, and the U.S. Air Force were accounted for by DR. JEAN S. FELTON, of the Oak Ridge National Laboratory, and BRIG. GEN. OTIS B. SCHREUDER, of the Air Material Command, Wright-Patterson Air Force Base. As guests from industrial health's organized activities were DR. EDWARD C. HOLMBLAD, Managing Director of the AMERICAN ASSOCIATION OF INDUSTRIAL PHYSICIANS AND SURGEONS, and DR. CARL M. PETERSON, Secretary of the Council on Industrial Health of the American Medical Association.

The Session Chairman, CAREY P. McCORD, informalized the session by directing his efforts towards the complete intermingling of the faculty and the visiting industrial physicians, thereby making this a true "Discussional." The faculty participants at the session were: DR. CARL E. BUCK (Public Health Practice), DR. THOMAS FRANCIS, JR. (Epidemiology), MR. FAY M. HEMPHILL (Public Health Statistics), DR. LEONARD E. HIMLER (Mental Health), MISS ELLA E. McNEIL (Public Health Nursing), MR. HARRY E. MILLER (Public Health Engineering and Sanitation), DR. MABEL E. RUGEN (Health Education), DR. NATHAN SINAI (Public Health Economics), PROF. CLARENCE J. VELZ (Public Health Statistics) and DR. SOLOMON J. AXELROD (Public Health Economics).

THE session of the first day was opened by the welcome of DEAN VAUGHAN who, through the Discussional, hoped to explore the possibilities of a greater role for the schools of public health in the preparation of men for careers in industrial health. He emphasized the value that derives from a university setting where a specialized training center can use the "latent" resources of the total university by employing the teaching services of other departments. Currently, certain training programs were being tried experimentally by DR. SELBY. One is a Fellowship program with the General Motors Corporation, involving four months of academic training in the School of Public Health, and eight months of field work in industrial plants. The three students now engaged in this program were in attendance at the meeting—DRS. JACK A. KANE, CHARLES E. CARLSON, and THOMAS E. LEWIS. The second program—a two-year course, with a year's residency in a hospital—now has

one enrollee, DR. JUNIUS W. MCCLELLAN. DR. VAUGHAN hoped that the Discussional on Industrial Health either would demonstrate merit in this program or offer suggestions for change.

A subject of considerable interest to the attending group was presented first: Problems in industrial medicine resulting from the lengthening of the expectancy of life. Through PROF. VELZ'S discussion certain conclusions were reached: the United States is no longer a young country, but is growing older twice as fast as the rest of the world, and in order to meet labor demands industry will have to use older people. In our approach to the saturation value of 180- to 185,-000,000 population in the year 2000, we must use the older worker or else pay him to do nothing. Accessions to the labor force are seen at ages 17 to 18, followed by a rapid decline to a zero point at age 30. The task for medicine at the present time is to conquer the diseases or injuries now eating into the young labor force —tuberculosis, pneumonia, and accidents. One can be less distressed by studies of the leading causes of death among the general population. The loss of working lifetime between 18 and 65 years of age must be altered to preserve a trained, stable labor force.

The group desired definitions of physiological age—of physical fitness, for these are employment determinants, not chronological age. It is the assignment of the industrial physician to measure this physiological capacity in order to evaluate the worker's ability to carry on beyond an arbitrary retirement point based on age alone.

DR. HIMLER stressed the emotional concomitants of aging, and stated that "psychiatrically" he did not believe in retirement—in fact, the word "retirement" should be retired. Psychotherapy is indicated for this group, and results are better than with most other states. We run old folks to the mental hospitals too early because we do not take kindly to their sleep reversals or memory changes. We plead for an educational program conducted by physicians that would attack errors in thinking and eliminate some of the stereotypes in our concepts of the aged. The dignity of the older person must be kept intact.

The du Pont program of weight reduction among obese employees was touched on briefly, and DR. FLEMING discussed the Company's efforts in trying to prolong the lives of valuable employees.

Through the comments of DR. SINAI, a gap in industrial medical functioning was demonstrated. Management needs advice on the organization of health insurance and hospitalization programs, but rarely seeks this aid from its medical personnel. Ordinarily industry purchases an insurance package, designed and delivered by the underwriter with no knowledge on the part of the Medical Director of the acquisition of such coverage. Particularly at the time of writing of labor-management contracts the physician's counsel should be sought.

In discussing the responsibilities of industry in providing total medical care for the worker and his family, the A.M.A.'s DR. PETERSON stated that if community facilities exist for care, there is no reason for industry to take over this function. This was endorsed by the Discussional group with enthusiastic intensity.

THE afternoon of October 27 saw the participation of faculty members from the School of Medicine—DR. H. MARVIN POLLARD (Medicine), DR. HENRY K. RANSOM (Surgery), DR. WILLIAM O. ROBINSON (Medicine) and DR. JOHN M. SHELDON (Medicine and Post-graduate Medicine). An effort was made to demonstrate those areas of investigation that could be carried out in industry—air pollution, dust control, effects of temperature on efficiency, fatigue, food and efficiency, and use of tracers. The answer to some industrial problems might lie in a greater knowledge of the pituitary adreno-cortical mechanism, for it is through this means that the body adapts itself to stresses to which it is subjected. DR. ROBINSON warned against the indiscriminate use of ACTH and Cortisone because of altered metabolic and psychic effects.

It must be mentioned at this point that little knowledge of the problems of industrial medicine seemed to be had by the academician. Industry was a kind of nebulous area where workers and physicians meet, but as to an understanding of the functions of the Medical Director, little was the possession of the medical teacher. This failure in communication is traceable to two figures—the medical school dean and the industrial physician himself. The former has not been too interested in introducing occupational medicine into the curriculum, and the latter has failed to orient his teaching colleague. That a cross-fertilization of ideas is indicated cannot be denied.

In discussing examinations for executives, the consensus pointed to the preference for such examinations in the plant health service. The sources of information for the estimate of the health of the executive were better in industry than in the outside clinic or the office of the private physician.

THE session's second day engaged the group in the consideration of civil defense and atomic warfare. GEN. SCHREUDER outlined the functions of the Health Resources Division of the National Security Resources Board and the responsibilities of the Military in Civil Defense. In a community the following health and medical services are needed in civil defense: first-aid and ambulance services, emergency hospital systems, casualty services, health supplies, blood services, laboratory services, sanitation services, nutrition services, medical services, veterinary services, records, morgue services, and health transporta-

tion services. The need for training industrial employees in first-aid was emphasized. Of considerable interest was the newly developed C-120 packet carrier—a plane that carries as an integral part of its fuselage, a mobile, detachable unit, approximately 38 feet long, nine feet wide, and eight and a half feet high that can be flown in, removed from its carrier, and set up as a surgical unit or as a laboratory, about which tents can be placed to establish quickly at the site needed, a functioning hospital.

DR. A. JAMES FRENCH (Pathology) discussed the bombing effects in Hiroshima and Nagasaki, and DR. JAMES V. NEEL (Medicine) described post-radiation effects, dividing these into genetic effects, burn problems (fate of keloids), blood dyscrasias, and cataract formation.

The maximum permissible doses of radiation were presented by DR. ISADORE LAMPE (Roentgenology); and MR. HENRY J. GOMBERG (Physics) outlined the physical principles of atomic weapon explosions. A well conceived disaster plan was read by DR. CHARLES-FRANCIS LONG, descriptive of preparations in the Philadelphia area.

IN THE concluding panel the present status of graduate training in occupational medicine was reviewed. DR. PETERSON discussed the two trends of such training—one being carried on in the schools of public health, the other in the schools of medicine. All such training is aimed primarily at certification in the form of a specialty board. The American Board of Preventive Medicine demonstrated in its establishment that there are non-hospital centered disciplines—always a point of contention in any consideration of an American Board of Occupational Medicine.

The American Academy of General Practice, DR. PETERSON reported, has expressed interest in instruction for its members in the ways of industrial medicine. About 85% of those doing plant practice are still part-time general practitioners. In an approach to indoctrination of fellow physicians, stress should be laid on the belief that this work in industry is a satisfying experience in medical practice.

DR. SHELDON described the manner in which teaching clinics have been taking to practicing physicians outside the Detroit metropolitan area. Included in these programs were the subjects of "Silicosis," and "The Place of the Cardiac in Industry." An elaboration of the training program alluded to during his welcoming talk was offered by DR. VAUGHAN. He believed that the industrial physicians and the health officer should be interchangeable in capabilities, and that certification in occupational medicine should require six months' field training in lieu of a hospital training residence. Further, for new staff physicians the Medical Director in industry must depend upon both the medical schools and the schools of public health for his supply. It is DR. VAUGHAN'S concept that the Medical Director is a health director whose interests carry into the community. The discussion on training ended with DR. SELBY'S mention of the two lectures on industrial medicine given to sophomores in the Medical School, and the 16 hours received by the Junior Class.

Comment

FROM reportorial writing to editorial comment is a jump, and any combination of these two is anathema to the news-offering journalist. However, this scheme of DR. SELBY'S materialized into an informal two-day meeting with characteristics seen rarely in most medical conclaves. The questions arose from both participating groups—both came to outline the problems, to discuss their features, and to attempt to reach workable solutions. Gratifying was the note-taking by Medical Directors who have spent a decade or two or three in their present positions. The teaching center had the opportunity at close hand to study both the make-up of the physician responsible for the health economy of the nation's workers and the problems attendant upon this physician's execution of his mission of maximal health for his particular plant population. The industrial practitioner learned of the need for indoctrination of the professorial world in medicine's areas of interest at the work scene.

Not all of the Discussional was learned. The excellent luncheons served by the School of Public Health made for easily created conversation pieces, and the dinner at the Barton Hills Country Club provided a good setting for the most informal of talk, small, medium, and large.

The first Discussional was a trial balloon. The result was successful, and perhaps this format—fluid and non-fixed—is the forerunner of refresher training for Medical Directors in industry. To the imaginative planning of DR. SELBY, and to the activation by DR. VAUGHAN and his coworkers, praise for discovering a new star in the constellation of learning.

Occupational Tuberculosis Among Interns and Nurses

LEOPOLD BRAHDY, M.D.,
New York City

ONLY in the last 25 years have we become aware that tuberculosis is an occupational disease among medical students, nurses, interns and other hospital personnel. The experience in all sections of the United States has confirmed the finding that the majority of student nurses who have no trace of tuberculosis on beginning training are infected before their graduation. This high incidence of infection occurs in general hospitals that do not have tuberculosis wards as well as in tuberculosis institutions. The consequence is that annually a number of nurses become ill with the disease. They must give up their work to spend several years under treatment at tuberculosis sanitaria. Even with the best of medical care, a few of them die each year, victims of a disease we know is preventable.

In 1928, a tuberculosis morbidity of 155 cases in 5364 observation years was reported from the Ullevaal Hospital in Oslo, Norway.[1] Since then there have been numerous reports, and among those in the last decade the most extensive is of a study in England which included 5091 nurses. It gives a morbidity of 2.3% per annum.[2] In a Canadian hospital, the annual incidence is reported as 1.7%.[3] Trudeau Sanitorium found that, of the nurses affiliating there, 2.5% developed tuberculosis during or after their affiliation.[4] At the University of Michigan Hospital about 2% developed the disease.[5] A combined study of six Minneapolis general hospitals shows 1.3% nurses developing tuberculosis during training or within one year after graduation.[6] This incidence in Minneapolis is low compared with other hospitals, but the authors find it is greater than that of young women in other occupations. In Boston City Hospital there was an *annual* incidence of 0.93%.[7] A report from the Metropolitan Hospital in New York City, on a five-year study, states that 3.4% of the student nurses developed tuberculosis.[8] At Kings County Hospital in Brooklyn, there is an over-all incidence of 6.3%.[9] In the Philadelphia General Hospital there was an annual morbidity of 4.8%[10]

Among physicians and medical students of Minnesota University in the classes of 1919-1932, 3.9% developed tuberculosis while in medical school and 3.3% after graduation, a total of over 7%. In the identical period, among students of law and recent law graduates of the same university only 1.3% developed tuberculosis.[11] Among medical students at Northwestern University from 1936 to 1940, 2.7% developed tuberculosis before graduation.[12]

A cooperative study under the guidance of the U.S. Public Health Service is now in progress in a number of hospitals which includes more than 20,000 student nurses. A summary of the recent literature with extensive bibliography by Eleanor C. Connolly has just been published.[13] A table showing the incidence found by many observers is included in the Report on the Prophit Survey.[2]

Student nurses are a select, young, and healthy group, and the majority of them are tuberculin negative when first examined. They are re-examined periodically so that the time of infection and of onset of the disease can be determined with some accuracy. The spread and development of tuberculosis thus is observed under almost laboratory conditions. Medical students and interns more recently have received the benefit of thorough periodic examinations. There is no longer any doubt of the occupational hazard in these groups. Other hospital employees have been observed less meticulously; occupational tuberculosis afflicts them too, though not so frequently. Graduate nurses and supervisors, social workers, ambulance drivers, technicians, ward clerks, elevator operators, porters, administrators, and everyone else in a hospital who has contact with the patients or the laboratories may be subject to the hazard of occupational tuberculosis. The extent of the hazard for them has not been accurately determined.

IN THE last two decades many states have extended their workmen's compensation laws to cover hospital employees who acquire tuberculosis because of their work. Prior to the extension of workmen's compensation coverage to them, each employee and his family carried the financial burden of his disability and his medical care. Compensation coverage shifts the major share of the cost to the employing hospital. The total of the financial burden is not changed by shifting it from the employees to the employer; it is only concentrated. Hospitals usually insure themselves against workmen's compensation costs. Paying a premium to an insurance company should not obscure the fact that the hospital carries the expense. Paying a premium for insurance does not decrease the financial burden. Because of the tuberculosis morbidity among their personnel the annual premium of hospitals has risen steadily, and it is now a serious burden which can be reduced only by reducing the incidence of occupational tuberculosis.

Besides the direct compensation expense to the hospitals, there is the waste in losing a skilled worker, and hiring and training a new employee; there is the slump in morale throughout the institution when one member of the staff is stricken with so serious an occupational disability. Also there are remote adverse effects which cannot

be measured or estimated. Among these is the effect on prospective candidates for nursing schools when gossip of tuberculosis among nurses spreads among high school girls and their mothers. This gossip is usually fantastic exaggeration, but because it has a core of truth it is difficult to correct. No one can guess how many girls have changed their choice from useful nursing careers to fields in which they are less needed because a nurse they know returned to their home town with tuberculosis acquired in her hospital. A serious loss accrues to the employee because compensation gives him only part of his wages during his illness. There is, of course, no compensation for the employee's misery and for the boredom of the months and years spent recovering from the disease, nor for the blasted hopes and sometimes blighted lives.

I emphasize the cost to the hospital to make one fact clear: it is sound economy for hospitals to invest in the prevention of occupational tuberculosis among their personnel. Even if not legally obligated, every hospital should provide medical care and sick pay for its employees disabled by tuberculosis owing to their duties in the hospital.

PERIODIC examination of personnel will uncover the disease in the early stage when it is amenable to treatment. An equally important reason for periodic examination of personnel is the protection of the hospital patients. Early discovery of every case of tuberculosis in the personnel protects the hospital patients from the danger of being infected by their attendants. This is comparable to safeguarding patients from pyogenic infection in the operating room. An operating room infection is promptly manifest; therefore it elicits energetic and continuing action by the hospital staff to eliminate the danger of recurrence of the conditions which may cause infection. An infection of a patient with tuberculosis is not known until months or years later. A specific case cannot be traced with any certainty to infection while in the hospital. Nevertheless, there is little doubt of the danger for patients where nurses and other personnel are not periodically examined, and it should elicit similar energetic sustained action.

More can be done than discovering the disease early in personnel; it can be prevented. The first step towards prevention of occupational tuberculosis is to uncover every case of communicable tuberculosis *among the patients*. That requires chest x-ray examination of every patient on admission. Only when both employees and patients have chest x-rays does the hospital break the vicious cycle: infection of personnel by patients with no one's being aware that these patients have tuberculosis, and infection of patients by the personnel who continue on duty for months before being aware that they themselves are ill with tuberculosis. The prevention of tuberculosis in the personnel is only one of the several reasons for admission chest x-rays. In the interest of the patients, admission chest x-rays should be done even if there were no occupational disease problem.

Some hospitals adhere to the archaic custom of not admitting patients with *known* tuberculosis. Admitting a patient known to have tuberculosis is a minor hazard compared to neglecting to uncover the unknown cases admitted to every general hospital. A hospital should admit known tuberculosis cases, and search for more cases among the other admissions. The hospital for its own welfare as well as to serve its community to the fullest extent should have its own tuberculosis wards or rooms. A hospital can cope best with its own personnel problem if it has tuberculosis specialists on its staff, and has nurses trained on tuberculosis wards.

Conducting roentgen examinations on personnel and patients will go far toward decreasing the occupational hazard. For its elimination, additional measures are required in tuberculosis wards or sections, involving techniques in handling the known tuberculosis patient. The most important of these measures are strictest cleanliness; special technique in handling sputa and everything which may have contact with sputum droplets in the air; dust control by chemical and mechanical means, and by training personnel in dust prevention methods; air sterilization by irradiation, or by chemicals or by ventilation or an effective combination of these.

Tuberculosis vaccination of certain groups of nurses may prove to be helpful, but when used alone it is of minimal value. The use of vaccination when the other measures are neglected is bound to result in failure in the long run. Tuberculosis vaccination should not be used for nurses unless combined with intensive use of all other methods. The easy parts of the "contagion technique," such as wearing masks and washing hands, are used in some institutions, but these, likewise, without the simultaneous use of other procedures, are of little value. In fact, half-measures create false security which increases the hazard of infection. Occupational tuberculosis continues because inadequate preventive methods are used while each institution postpones a thorough study of what combination of measures is suited to its particular conditions. There is, alas, no single miracle method or combination of methods suitable for every institution.

HOSPITALS are one of the great industries and large employers in the United States. Other industries have one or more occupational disease hazard which in most cases has been met successfully. Hospitals must use the proved methods of industrial medicine to combat their own occupational hazard. The primary step is for each hospital to study the conditions within its own walls and lay the groundwork for tuberculosis prevention. Personnel must have periodic examinations including x-rays and tuberculin tests.

All patients must have admission chest films and records must be kept, both of manifest tuberculosis and of tuberculin conversion in personnel. It must be ascertained when, where and under what condition disease became manifest or infection occurred. When accurate records have been continued for a number of years they should be published. Though a score of leading hospitals have reported their experience, this is not enough. Hospitals in every locality, treating different segments of the population and drawing personnel from various sections should publish their findings. Making available the observations under varying conditions prevailing in different hospitals is an important contribution toward elimination of this occupational disease. Several methods of control must be used and their effects watched. They must be modified and adapted to the conditions present in the institutions studied, and ways of improving them actively must be sought. These things cannot be relegated to a nursing supervisor, or to a roentgenologist, or to a tuberculosis physician primarily interested in therapy. Their efforts, as well as others, are required, but all should function under the supervision of a physician whose primary interest is to control this intramural epidemic. He must bring to the problem the viewpoint and attitude of an industrial physician for the hospital. This will take tact, time, energy, and money.

A few hospitals successfully have decreased or eliminated occupational tuberculosis. It can be done in every hospital but this requires each hospital to exert its efforts to that end. The hospital owes that duty to its employees, to its patients, and to those who support it.

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Physicians' Cooperation

WORKMEN'S Compensation is part of our social structure. Its success in large measure depends upon cooperation from the medical profession. The trend is towards greater coverages and benefits affecting more and more people gainfully employed. Restrictive legislation as to matters which might properly be classed as professional disciplines can probably be avoided by developing a higher standard of intelligent, honest and conscientious medical service under our present laws. Full medical and hospital services should be advocated for all types of injury or illness of *occupational* origin. There is a great need of awareness on the part of the medical profession of the socio-political trends toward compulsory employer-paid *non-occupational* disability benefits. Every proposed legislative change affecting medical practice should be carefully studied, and medical advice should be furnished our legislators in order that changes may promote rather than retard better medical service to our fellow man.

—From "Trends in Compensation Legislation," by CARL T. OLSON, M.D., presented before the Section on Industrial Medicine and Surgery, Southern Medical Association, St. Louis, November 15, 1950.

ASSOCIATION NEWS

THE Annual Meeting and election of officers of the NEW ENGLAND CONFERENCE OF INDUSTRIAL PHYSICIANS AND SURGEONS was held at the Harvard Club, Boston, November 2, 1950. New officers elected were JAMES I. ROBERTS, M.D., President; J. ALLAN THOMPSON, M.D., Vice-President; HALSTEAD G. MURRAY, M.D., Secretary and Treasurer. Directors for 1950-51 are PRESTON N. BARTON, M.D., STANLEY SPRAGUE, M.D., F. W. BARDEN, M.D., HENRY F. HOWE, M.D., and CLARENCE BURT, M.D. After the business meeting, a talk was given by MR. EDWARD CUNNINGHAM, of Blue Cross and Blue Shield, about the changes in those organizations, and this was followed by an interesting discussion period. MR. JOHN MARTIN, Office Manager of the New England Telephone and Telegraph Company medical office, exhibited three-dimensional colored pictures of his trip this past summer which included Ireland, Scotland, England, Paris and Switzerland.

ALEX M. CARR, M.D., has been transferred from Cleveland, Tennessee, to the position of Director of Health District No. 2, State of West Virginia Department of Health, at Lewisburg, West Virginia, with a possibility of developing a training center in that area.

EMORY VINTON JORDAN, M.D., has accepted a position as Plant Physician at the American Viscose Corporation plant in Nitro, West Virginia.

MARVIN L. AMDUR, M.D., announces the establishment of the Buffalo Industrial Hygiene Laboratories in conjunction with the Blanchard Industrial Clinic, at 755 Tonawanda Street, Buffalo 7, New York.

Ophthalmological Tour

ROLAND I. PRITIKIN, M.D., Rockford, Illinois, represented the AMERICAN ASSOCIATION OF INDUSTRIAL PHYSICIANS AND SURGEONS at the XVI International Congress of Ophthalmology which was held in London, England, July 17 to 22, 1950. Most of the meetings were held in the Great Hall of Friends' House, and were attended by about 1200 ophthalmologists representing 66 different countries. Usually this conference is held every four years, but because of war complications, the XVI International Congress is the first that has been held since 1937.

Among possibly 60 attending from the United States were DRS. T. H. DUNNINGTON and CONRAD BERENS, of New York City, DERRICK VAIL, KENNETH ROPER and GEORGE GUIBOR, of Chicago, and F. H. ADLER and E. B. SPAETH, of Philadelphia. At the main banquet the chief address was made by the HON. LEWIS DOUGLAS, our Ambassador to Britain. DR. RONNE, of Copenhagen, and DR. TAGENROTH, of Gothenberg, were among those at DR. PRITIKIN'S table. The man who opened and closed the Congress was PROF. DR. J. W. NORDENSON, of Stockholm, inventor of the Nordenson fundus camera, an elderly man, amazing in his ability to stand up before the audience without a note in his hands and make the opening address on Monday morning and the closing address on Friday afternoon in the three official languages of the congress—English, French and Spanish—without any hesitancy whatsoever. The Swiss professors all talk five languages, and it was said that PROF. DR. FEIGENBAUM, of Jerusalem, can speak 10. This gathering of outstanding, world-renowned ophthalmologists was an exceptional opportunity to meet such individuals and to discuss the various phases of the field of ophthalmology. It is hoped that these meetings can be held regularly in the future, and it is planned to have the next Congress four years hence, the exact location to be decided at a later date.

One of the outstanding exhibits at the conference was the Exhibition of Industrial and Social Ophthalmology, which covered such subjects as "The Use of Optical Devices in Close Work," "The Care of the Blind," "Welfare," "Rehabilitation," "Vocational Training and Employment," "The Education of Management and Workers in the Principles of Accident Prevention," "Industries with Special Ophthalmic Problems," "Miners' Nystagmus," etc.

Some of the books presented at the Congress were "Occupational Eye Diseases and Injuries," by JOSEPH MINTON, F.R.C.S.; textbooks by DRS. ARNOLD SORSBY and EUGENE WOLF; a textbook on the eye entitled "Essentials of Ophthalmology," published by J. B. Lippincott Company, and written by ROLAND I. PRITIKIN, M.D. (Chapter 6 of this book deals only with industrial ophthalmology).

Among the exhibits at the London School of Hygiene and Tropical Medicine was one entitled "Some Aspects of the Anatomy and Pathology of the Eye," by EUGENE WOLFF, London; another by ARNOLD SORSBY, London; and one on "The Bacteriology of Ocular Infections in Mid-west U. S.A.," by ROLAND I. PRITIKIN, M.D. Acknowledgment in the latter exhibit was made of assistance by M. L. DUCHON, M.D., and HENRY FARMER, B.S., bacteriologist at the Rockford Memorial Hospital, Rockford, Illinois, U.S.A. In the Clinico-Pathological Exhibits was included one on "The Aqueous Veins," by K. W. ASCHER, Cincinnati, one by DR. R. CASTRO-

Dr. E. C. Holmblad addressing the Luncheon Session of the Joint Meeting of the Section on Industrial Medicine of the Ontario Medical Association and the Industrial Medical Association of the Province of Quebec, at Niagara Falls, October 11-13, 1950. At Dr. Holmblad's right is Mr. R. Comette, Division Manager, Ontario Paper Company, and at his left is Dr. J. K. Bell, Medical Director, Ontario Paper Company

VIEJO, of New York, on keratoplasty, and one on the Pritikin Hand Tangent Screen. Among the movies shown was one on "Functional Polarization of the Retina and the Development of Vision in Transplanted Embryonic Salamander Eyes," by L. S. STONE, and one on "Ophthalmic Surgery under Field Conditions," by DR. ROLAND I. PRITIKIN. One of the many subjects for discussion at the Congress was "The Clinical and Social Aspects of Heredity in Ophthalmology." The openers for this discussion were PROF. L. H. SNYDER, Norman, Oklahoma, MISS IDA MANN, London, and PROF. A. FRANCESCHETTI, Geneva. Among those formally listed as taking part in the discussion were DR. W. J. B. RIDDELL, United Kingdom, DR. N. CHOME, Switzerland, and DR. ROLAND I. PRITIKIN, U.S.A. There were many industrial plants exhibiting, such as J. J. Cash, Ltd., Coventry (jacquard looms); Bristol Aeroplane Co., Ltd., Bristol; and Courtaulds, Ltd., Coventry (rayon).

On leaving London, DR. and MRS PRITIKIN went to Paris, where DR. PRITIKIN attended the 57th French Ophthalmological Congress held July 24 to 28. This was a conference of some 300 ophthalmologists, mainly from France and North Africa. From Paris, they went to Zurich, Switzerland, to spend two days at the university eye clinic there with PROF. DR. MARC AMSLER, then to Berne for two days with PROF. DR. HANS GOLDMANN, head of the eye department of the University of Berne. DR. GOLDMANN demonstrated a method he had developed for the removal of non-magnetic intra-ocular foreign bodies. At Geneva, DR. PRITIKIN spent two days with PROF. DR. A. FRANCESCHETTI. During the entire trip he was keenly aware of the attempts by ophthalmologists throughout the world to handle ocular injuries and occupational eye diseases by more improved methods.

LETTERS

Disaster Precautions

TO THE EDITORS: Following are the Recommendations of the Industrial Medicine Committee, Section 5, Civil Defense Council, and of the Industrial Defense Committee, PHILADELPHIA INTERSTATE ASSOCIATION OF INDUSTRIAL MEDICINE: The Committee conceives its function to be that of guidance for all those connected with industrial health in the Philadelphia metropolitan industrial area. The Committee stresses that this is a medical report, and although a great many other incidents will occur to cause casualties, they are not strictly medical problems, and their supervision should be delegated to another individual in the plant. We believe that every industrial organization must now learn to plan the best possible health for its employed group before an attack; learn how to help them through an attack; and learn how to facilitate their exit to safety and their return to production as soon as possible. In order to accomplish these objectives, we propose that the responsible person must think in terms of (1) his local plant problem, and (2) the general industrial problem. If his plant is so badly hit as to be unable to function, his local problem is the only thing that can engage his attention. If not hit, or only slightly affected, both local and general problems must have his cooperation.

I. *The Local Plant Problem Should be Planned under the Following Headings:*

1. How and where to cache sufficient medical supplies safely to survive a directed missile or atomic attack.

2. If possible, arrange immediate blood typing of all employees by one of the following methods: (a) within your own group; (b) contact the Red Cross; (c) contact the Blood Typing Committee of Civil Defense.

3. The employed group must have individual means of identification in accordance with Civil Defense rules. Contact Civil Defense when the standard means of identification have been announced.

4. Train personnel into teams to facilitate the movement of the injured and the removal of the dead. Classify all of your employees NOW into those who previous to attack can walk and those who must ride, and plan transportation for them.

5. Urge Red Cross first aid courses for all employees capable of understanding them, and contact Red Cross to arrange for instruction.

6. Find out from Civil Defense to which struck plant your medically trained personnel must be assigned if your plant is unhurt.

7. Watch for and arrange the use of authority within the plant to order blood donations in an emergency.

8. In the event your plant is struck, through Civil Defense you will be able to get extra medical help. This help will be in the form of medical teams. Contact Civil Defense NOW to learn from what source your help can be expected.

9. Practice drills, if applicable, for what to do during the first 30 seconds after an atomic attack.

II. *The General Industrial Problem Includes the Following Topics:*

1. Publicize escape routes designated by Civil Defense.

2. Arrange caches of medical supplies on the periphery of the entire target area, if possible. If not, Civil Defense will give you information on the subject.

3. Arrange manpower tools on the periphery of the target area, if possible. If not, contact Civil Defense for further information.

4. Some authority must designate which plants work and which stop work to act as living blood and manpower sources after attack.

5. Absolute authority must be vested in each physician to designate who shall have emergency treatment and who shall not after attack.

The Industrial Medicine Committee, Section 5, includes CHARLES-FRANCIS LONG, M.D., *Chairman;* R. RALPH BRESLER, M.D.; WILLIAM D. FRAZIER, M.D., and DAN H. PERSING, M.D. The Industrial Defense Committee of the PHILADELPHIA INTERSTATE ASSOCIATION OF INDUSTRIAL MEDICINE consists of CHARLES-FRANCIS LONG, M.D., *Chairman;* GLENN S. EVERTS, M.D.; WILLIAM D. FRAZIER, M.D.; and DAN H. PERSING, M.D. —CHARLES-FRANCIS LONG, M.D.

Eye Injuries in Event of Disaster

TO THE EDITORS: The Joint Committee on Industrial Ophthalmology feels strongly about the danger of concentrated detergents to eyes. DR. HENRY F. SMYTH, of Mellon Institute, has been in touch with the Joint Committee with reference to these labels and the request by the Joint Committee that packages of detergents for home use, or sent

commercially, should carry a warning label concerning the concentrated substance. We, therefore, sent him the following statement as of October 24: "The question of detergents and warning labels was again brought up at the annual meeting of the Joint Committee on Industrial Ophthalmology, and the members of the Committee voted that the following statement be sent to Mellon Institute for consideration and guidance: 'Detergents are substances that affect surface tension and destroy the normal bacteria barrier, and in so doing we must protect the mucous membrane of the eye and nose against their use.' The Joint Committee still feels strongly that detergents for household use should have labels to the effect that *in their concentrated form they are dangerous to the eye.* If gotten into the eye accidentally, copious irrigation is indicated and a visit to the doctor (with some abridgement of that advice but a clear statement of the danger of the product in a concentrated form)."

THE techniques that have been approved by the Chicago Civil Medical Defense Council as being the most desirable treatment for eye injuries in the event of disaster were approved on October 8 by the Joint Committee on Industrial Ophthalmology of the American Medical Association and the American Academy of Ophthalmology and Otolaryngology, and were submitted to DR. ANDREW C. IVY for use of the Chicago Civil Medical Defense Committee. They are as follows:

CLASSIFICATION AND TREATMENT OF EYE INJURIES IN EVENT OF DISASTER:

Advance Roving First Aid Man:

1. Fill eye with ½% pontocaine in 1-3,000 zephiran (to be specially packaged).

2. Cover eye with sterile cloth from roll carried.

3. Pain in eye injuries other than burns, not too great—hypos not necessary before patients get to next station.

First Aid Collecting Station:

1. Separate out severe lacerations, perforations and obviously traumatized eye cases—to send to hospital or casualty station where there is an ophthalmologist, as follows: (a) In laceration of lids, leave same bandage on. (b) Severe injuries of globe—send to rear with same simple bandage on. *If at all possible—as stretcher case.* (c) If sliver of foreign matter (glass, metal or wood), do not touch—close with bandage and send patient as directed above. (d) Tag everyone who has not already received preventive tetanus antitoxin—so as to be sure it will be given.

2. Burns in any one of three categories: thermal, radiation, chemical: (a) Anesthetize again if necessary (same pontocaine—zephiran). (b) If chemical, irrigate copiously if possible. (c) Hydrosulphosol into eye using new capsule form—after holding capsule in hand for a moment to warm oily contents. (d) Pad securely with pressure bandage. (e) Morphine hypo if necessary. (f) Send to a hospital or casualty station where burns are being treated and where there is an ophthalmologist.

3. Foreign bodies: (a) If on cornea anesthetize (same pontocaine—zephiran). (b) Use applicator wound with cotton to remove foreign body (or closest substitute). (c) If very deep close eye with same sort of patch and send patient to hospital or casualty station where there is an ophthalmologist.

Casualty Station—may or may not have ophthalmologist—in either case:

1. Careful inspection of eye: (a) To further separate out serious eye injuries overlooked at a forward post. (b) To recognize any unrecognized damage lay personnel should look for: severe pain in eye (other than burn cases); change in size of pupil or shape of pupil; blood in anterior chamber; protrusion of tissue. (c) Such cases cover with same bandage and send to hospital or to ophthalmologist. (d) Embedded foreign body should be sent to an ophthalmologist.

2. Treat and redress burns of external eye—as in collecting station.

3. Dress minor lid damage.

Hospitals:

Here there will be an ophthalmological operating team—but we must ever realize that in some cities one-half of the hospitals may be destroyed by one bomb. Then the ophthalmologist stationed at some of the casualty stations (in Chicago, for example, there will not be enough ophthalmologists to man all the casualty stations which will be required) will have to operate with: (1) Minimum variety of instruments. (2) Reduced volume of drugs and dressings. (3) Sharply reduced number of assistants.

The ophthalmologist should have ready *now* in his own bag (kept for this purpose only) *all* he needs to start to work with (drugs, dressings, instruments): at casualty station (if he gets a chance there); or to start work at rear hospital where normally there is no ophthalmological service.

This is important so one does not have to stand and ask someone (already burdened by excessive duties) to "get this—and get that."

General Advice:

Our part, as ophthalmologists, is:

1. To assist Directors of local (or regional) Civil Medical Defense organizations to implement and formulate the program *they set up* with much more give than take, i.e.: (a) accept agreed medication for First Aid Roving Teams; (b) accept agreed Collecting Station techniques; (c) accept agreed Casualty Station procedures; (d) accommodate to hospital needs.

2. Assist those agencies set up to teach and train *not only* First Aid, but *Self-Help* (the one great constructive *good* thing about this whole catastrophe defense effort) by: (a) Writing simple instruction sheet to be inserted into Manuals, best a loose-leaf book which can be used by ourselves, the Red Cross, and the citizens trained to teach.... (b) Taking on teaching when asked, or, better yet, volunteering NOW (it can happen tomorrow!).

3. Offering help and *time* now—walking into the office of the Director to say "when, where, how can I help?"

—HEDWIG S. KUHN, M.D.,
Secretary, Joint Committee
on Industrial Ophthalmology.

BOOKS

Therapeutics

THERAPEUTICS IN INTERNAL MEDICINE, FRANKLIN A. KYSER, M.D., F.A.C.P., Editor, Thomas Nelson & Sons, New York, Edinburgh, Toronto, 1950, pp. 715, $12.00.

INDUSTRIAL medicine consistently has been stigmatized as a division of medicine without therapeutic

requirements beyond surgery. In part, this represents praise since it tends to place occupational health foremostly in the category of preventive medicine and public health. Even that language will outrage many industrial physicians who not yet have learned the over-all significance of positive health. For many long years, emphasis throughout medicine has been on diagnosis. Therapy was relegated to a minor role. In the past few years, the advent of the "sulfas," the antibiotics, the newer hormone fractions and, particularly, ACTH, has rehabilitated drug therapy until its position in medicine is essentially paramount. Industrial medicine has profited by this therapeutic renaissance.

The appearance of Kyser's "Therapeutics in Internal Medicine" could not have been better timed. This authoritative publication, representing contributions by scores of experienced therapeutists, affords the currently last lecture in medicine treatment. However much the industrial physician may be the plant public health officer, a position of high estate, he is also the clinician. As a therapeutist, this new book may well become his right arm.

Laboratory Examinations

A SYLLABUS OF LABORATORY EXAMINATIONS IN CLINICAL DIAGNOSIS, edited by THOMAS HALE HAM, B.S., M.D., Harvard University Press, Cambridge, Massachusetts, 1950. Paper bound. Varityped. Off-set lithography; pp. 496. $5.00.

BY ONE definition, but there are others, a syllabus is but the section headings of any extensive treatise. In this instance, this term modestly belittles a tremendous wealth of procedure and interpretation related to the clinical laboratory world. While this compendium soon will appear atop many a laboratory work table, it seems that the editor's emphasis is toward the training of medical students in laboratory significance and in the guidance of physicians in the interpretation of laboratory findings. Among medical students in every medical school, a few publications attain to a reverential status.... near Bibles. This book is destined to that happy state. In facetious vein, it might be claimed that so far as laboratory lore is involved, this book makes a brain almost unnecessary. More seriously, the need for technique "grubbing" is hereby reduced to a minimum. Indeed, time and thinking are saved thereby but some grubbing possibly is essential to growth and development.

Any finely printed volume is likely to command the reader's admiration for an outstanding product of the printer's art but there arises no sympathetic grasp of the endless details entailed in reaching that splendid output. When, however, a large volume is turned out by the varitype method, even the little informed may be bowled over by the realization of the endless, painstaking labor involved. Affection at once is directed to the varityper and minor typographical errors are passed over even joyously. One cannot escape the conclusion that somehow this book is a labor of love.

This publication lists 99 contributors and critics. Among them there must have been a conspiracy to hold the book's contents to the routine, the usual, the run-of-mine need in laboratory procedure. One looks in vain for mention of the polarigraph as a laboratory instrument, for presentation of laboratory methodology in mercury, arsenic, lead or fluoride poisoning. Continually the industrial physician is complaining that the general practitioner, confronted with occupational diseases, is often painfully incapable of meeting acceptable diagnostic requirements. Equally, the industrial physician is appalled by the unashamed incapacity of laboratory directors and technicians to conduct the sometimes relatively simple tests related to the 3000 occupational diseases arising rarely or often among the nation's 62 million industrial workers. Why, without consternation, may not hospital or detached clinical laboratories, go about the business of determining urinary sulphates in benzene poisoning, or hair analyses in suspected arsenic poisoning, or mercury in urine, or lead in blood? Fundamentally this deficiency stems from inadequacy in student training in occupational health, albeit every physician participates in industrial medicine. But this book lives up to its stated purpose. So what justification has any reviewer to register his disappointment over failure to find what he hoped at long last to find therein?

Noise

LESS NOISE—BETTER HEARING, Sixth Edition. HALE J. SABINE, Chief Acoustical Engineer, The Celotex Corporation, Chicago; pp. 104, illustrated. $1.00.

NOISE is a step-child in the family of harmful industrial exposures. Whenever the industrial physician lifts his voice condemning noise because of the damage it may produce, other voices often shout him down, claiming that more important physiologic needs require prior consideration. Not noise but the elimination of noise, too often is relegated to the future. Therefore, this Journal seeks opportunity to review all publications directed to noise abatement.

This present publication is not a medical book; it is not designed for the physician in or out of industry; neither is it for the engineering industrial hygienist. Foremostly, it is fashioned for the architect, and centers about sound absorbing materials, acoustics of auditoria, noise reduction through acoustical treatment and sound insulation. When that time comes when the deafened ears of management listen to the sound pronouncement of the industrial physician as to the ravages of noise, this book in hand will serve in the total presentation. The book promotes the wares of the Celotex Corporation, but does so in a manner so scientific as to command attention and admiration.

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Industry and the Proving of New Therapeutic Agents

THE historic "bravest man in the world" is he who first ate an oyster. That degree of bravery now seldom needs display in a world in which every one wants to try out something. As to drugs, all testing and retesting is requisite to public safety, otherwise there arise such flagrant episodes as the "jake paralysis" catastrophe or the malodorous Massengill diethylene glycol disaster.

Few physicians and even fewer of the non-technically trained public are conversant with the painstaking efforts to clothe every truly scientifically developed new product with an overplusage of safety. Some precautions are dictated by the utter good faith of the producer; some are legally imposed. After the chemists have provided a set of slightly varying substance—like the photographer's proofs seeking the best of several—the day arrives when dosage, toxicity, incompatibilities, and limitations must be established. Then come into the picture bacterial cultures, animals—large and small. Every manufacturing laboratory has within its own personnel human subjects for the establishment of freedom of objectionable features of new substances. Many an earnest chemist or industrial hygienist, or physician has had applied to his skin literally hundreds of patch tests seeking safety of workers or the general public. After a satisfactory measure of acceptability has been established, then comes the time when a wide spread of experience is needful. No physician is likely to be impressed by a "large series of two cases," but intelligent application in 1127 or 2389 cases inspires confidence. More and more medicine is becoming statistical. The larger the coverage, the better the statistical situation. How to acquire this broad, safe experience poses difficulties. Manifestly, if a new drug is directed to typhoid fever, its efficacy must be tested on the typhoid patient; if for malaria, on the malaria patient, and so on.

So extensive has become the need for harmless testing, that regularly, hospitals, colleges, military units, and police forces are beset by those importuning towards some form of testing or survey. This does not constitute experimentation. The participants are not "guinea pigs." All well-planned, carefully-controlled studies represent sincere effort to serve the ailing world through the best. Every physician knows that in a single instance of resistant dermatosis, a half dozen remedies, one after the other, may be required to reach the patient's particular need. This is not experimentation but betimes might constitute well meant "over-treatment."

Industry has not escaped the army of "tryers-out" of the new. Almost daily large industrial medical units are beset by requests for chest surveys, cancer surveys, eye surveys, dental surveys, heart surveys, alcoholism surveys, or, instead, participation in massive value determinations of the worth of new vaccines, new salt tablets, new refreshments, new soaps, new vitamins, new cold remedies, and new protective creams,—every new panacea.

However harmless any of these procedures may be, their very number tends to make the total a self-limiting affair. Truly every good industrial physician continually seeks the best for his patients in industry, but any enterprise of this character introduces difficulties. Some diffi-

culties are now mentioned, although somewhat obvious:

Anything out of the usual that reaches into an industrial department is upsetting to workers. The mere walking through a department of a blind man with a leader dog will be reflected in that hour's production. The best example may be found in the age-old prohibition of women in mines. All miners drop their tools and the day is over; they know that usual attention to work is long diverted.

The industrial physician has the duty to avoid the unnecessary unusual.

The furnishing of any substance avowedly new, whether vaccine or vitamin, to workers even on a voluntary basis, is sure, when the involved work population is large, to lead to some degree of legal liability. Regardless of the nature of the substance, all manner of ensuing malevents are sure to be attributed to the trial substance. Uncoated bread pills, undisclosed as such, may lead to bitter charges of gastric bleeding, hemorrhoids, headache, weakness in sexual potency, broken bones at home, and any other untoward event.

Upon the advent of any new medicament which may be on hand in the industrial dispensary, the attitude of workers splits rather neatly into two categories. The ones who receive not, complain nastily that they have been "given the same old white pills—nothing new around here." The receivers equally complain, "Trying me out as an experiment. We're nothing but guinea pigs." Internecine warfare.

However carefully explained to workers, few of them grasp the significance of being a control or blank. Loud may be the protestations against being "experimented on," but louder is the voiced indignation if ignored. If provided an undisclosed placebo and notified that some within the entire group may develop minor discomfort such as nausea, headache, sleepiness, the placebo taker group sometimes will provide a higher frequency of side reactions than the test jury. Hell has no fury greater than that of a placebo taker who develops all the possible reactions.

Manufacturers, good and bad, have awakened to the obvious that a published scientific paper prepared by a physician extolling the virtues of a product is worth many pages of cunningly-prepared paid advertising copy. This newer knowledge is threatening to the orderly scientific proving of the truly new in therapy and medical procedure. These "planted studies" long after the therapeutic mold has been poured, serve no useful purpose apart from the mercenary. Their publication in little-discriminate fashion but reflects on the publisher. Limited, judicious field trials, well controlled and with known safety to participants, are helpful to the progress of medicine and the betterment of all the people. But this is true only when all manner of preliminary steps have attended the development of new materials of outstanding prospective merit. All other procedures but prostitute developmental medicine. Field trials of new products should be reserved for the most circumspect of medical circumstances.

The Home Front Medical Stations

WILL the armed resistance to aggression still stay under the United Nations' banner as a localized action, or will a world conflict result? Regardless of this point, arms and more arms are needed. Industry must gear itself to greater and even greater production. Physicians will be called to the colors, and again a shortage of medical men will exist in American civilian and industrial life. Could there be a finer task for American women physicians than to ask for and receive the responsibility of manning the medical plants of the nation to help in the stabilization and care of the workers? Undoubtedly, women workers will be called back to plants all over the nation. Called to industry, many family women may well become dual personalities almost overnight with two highly concentrated interests—interests that are often at variance.

The need to help these women produce the arms calls for brains, tact and understanding. To be behind the men who man the guns may not be too dramatic or glamorous, but it is highly essential, for our wars are now wars of supply.

Fatigue, safety, personal hygiene and rest periods all play an important part in women workers. Who should be better able to understand these needs than women physicians?

What better assignment than "to man the medical stations on the Home Front" and produce the weapons of conflict to bring us early victory and the hope of a peaceful world?

—L. G. GIBERSON, M.D.

Pages 593 - 594 removed for index

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REFERENCES: 1. Arminio, J. J., and Sweet, C. C.: Indust. Med. & Surg. 18: 509 (Dec.) 1949. 2. Tebrock, H. E.: ibid. 19: 39 (Jan.) 1950. 3. Schwartz, E.: Ann. Allergy 5: 770 (Nov.-Dec.) 1949.

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—*Chicago Daily News.*

"Science Shorts"

IN ONE hospital it has been found that the new chlorophyll tablets are effective in controlling odors from ulcerative colitis and cancer. Doses varied from four to 10 tablets daily. It was also found that two tablets daily curbed post-operative halitosis....Malaria, long a health problem in the southern states, has decreased from 135,000 reported cases in 1935 to only 4,000 in 1949.
R.N., November, 1950.

Learn and Teach

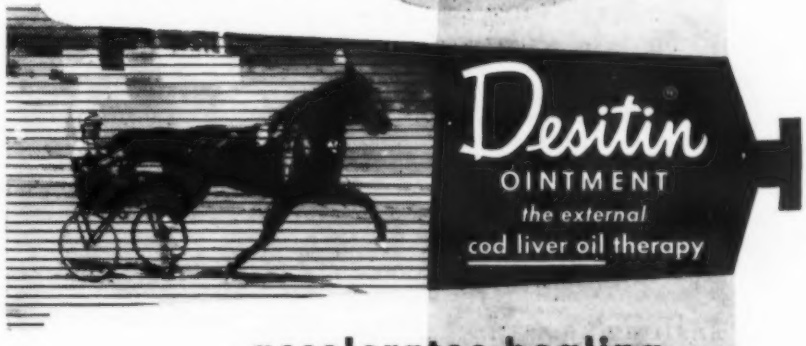
THE school bell must ring each term for butcher and baker, for doctor and lawyer. He who does not constantly enrich his mind with new knowledge may find eventually that his capacity for forgetting will leave little of value behind. And no dog, however old, need ever say that he can learn no new tricks. The doctor, wherever his path may lie, can still emulate to some degree Chaucer's clerk of Oxenford, for "—gladly wolde he lerne, and gladly teche."
—From an Editorial in *New England J. Med.*, November 9, 1950.

ROBERT B. O'CONNOR, M.D., Assistant Professor of Industrial Medicine, Harvard School of Public Health, addressing the Third Gulf Coast Regional Conference on Industrial Health at Houston, Texas, October 14: "It is true that the vast numbers of small plants constitute a considerable challenge in furnishing really effective medical service. It is not true that we must grope for methods and plans. Effective programs are presently in use and their value has been proved."
—*Boston Globe*, October 14, 1950.

The Geriatric Front

BUSINESS has at last found that the aged population is increasing. With this increase there are business opportunities. Drug firms are now preparing special medicines for the aged—some of them good, others are the bunk. Statisticians have drawn diagrams showing to what ailments the aged are subject; naturally remedies will be offered to combat those ailments common to the aged—at least thought to be common. Doctors are interviewed and tell of some magic powder or tablet which will control arteriosclerosis. Already lay publications are telling

even in stubborn
slow healing **wounds**
burns
ulcers
(decubitus, varicose, diabetic)



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1. Behrman, H. T., Combes, F. C., Bobroff, A., and Leviticus, R.: Ind. Med. & Surg. 18:512, 1949.

the public about lipotropes for arteriosclerosis. Thus when you are called to see a person suffering from coronary artery occlusion, you are told by the family that their friends are taking lipotropes for the same disease. Then we shall hear about cathartics for the aged, antacids, harmless tobacco, vitamins of the therapeutic type, hormones, including hormone creams for the skin. Then we shall see special furniture, electric typewriters to make work easy, woolen underwear, and maybe a return to red flannels. There may be smaller automobiles. There are all sorts of possibilities which advertising agencies will uncover. This does not mean that some of the ideas may not be worth while. Moderation is needed.

—Editorial by M.W.T., in *Medical Times*, November, 1950.

Next to Godliness

IN ENGLAND now, if one correctly interprets a peripatetic correspondent of *The Lancet*, cleanliness, even if it still ranks next to godliness, comes dearer. The discussion is initiated by the comment of a Danish visitor on the dirtiness of the food and centers on the difficulty of attaining, under certain circumstances, even such a rudimentary level of ordinary decency as washing the hands after the toilet ritual. This correspondent, a woman, found that a penny was necessary to gain admission to the public lavatory in Leicester Square and that three-pence was required for the use of a towel after washing. Men, she suspects, although they are frequently charged not even the penny, do not often bother with the ablutions, the desirability of which should seem to obvious, but perhaps she has a grudge against men. Soap is becoming less scarce in England, water is still available for necessary functions, and it would seem that the Ministry of Health, if none other, might engineer an opportunity for the fastidious to use a paper towel at something under threepence a wipe. There is no question that an accurate inquiry into

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the post-excretory habits of Americans, with so many opportunities for cleanliness freely available, would be equally disconcerting. When the inescapable surmise is applied to restaurant personnel the prospect of dining at home seems doubly attractive.

—Editorial in *New England J. Med.*, October 26, 1950.

Medical Services

ONE of the urgent unmet needs in industry is the almost complete absence of medical service for workers in small plants. The familiar cigar-box first aid kit symbolizes medical service to the two-thirds of American workers who are employed in plants having less than 500 workers. Economic factors make it impractical for most small plants individually to provide pre-placement and periodic physical examinations and the other necessary in-plant medical and nursing services. Moreover, too many large industrial organizations still offer poor services or none at all. Yet when industries are shown that prevention of occupational disability pays financially, they will consider seriously offering good services. The health department can stimulate groups of small plants to provide in-plant medical and nursing services by group financing of costs of medical and nursing personnel and physical facilities. Two county health departments in Georgia have successfully promoted such services. Similarly, the Connecticut Division of Industrial Hygiene has played a leading role in setting up small plant programs in Hartford. It should not be forgotten also that example is a good teacher. Let the health officer examine the medical program, if any, which is available to the employees of the health department. Many other activities of the public health department, such as nutrition and dental health, might be discussed in the same vein. Whether these activities are planned in connection with a formal industrial or "adult" health program, or whether they are integrated into the structure of the fundamental work of the department, does not matter. Important only is the fact that the working population is recognized and given service.

—From "How Good Is the Industrial Hygiene Program," by HERBERT K. ABRAMS, M.D., in *Am. J. Pub. Health, October, 1950.*

Improvement

AMONG industrial policyholders of the Metropolitan Life Insurance Company the average annual death rate for pneumo-

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71% of the largest
industrial plants in the U. S. A.

Horse sense about **ATHLETE'S FOOT**

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(Archives of Dermatology and Syphilology for April, 1942.)
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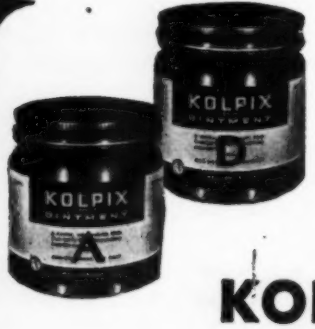

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B_{12} is among the most potent of known microbiologically active substances.[3] Animal studies indicate that it increases the ability of the normal mammal to utilize protein.[4] With a high protein diet, 0.01 mcg. of vitamin B_{12} per day was found to increase significantly the growth rate of B_{12} deficient rats. In another study, growth response of B_{12} depleted rats was proportional to the B_{12} in the ration within the critical range of 0.025 to 0.1 mcg. per rat day.[5]

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---

(1) Schweigert B. S.: Significance of Vitamin B_{12} and Related Factors, J. Am. Dietetic Assoc. *26*:782 (Oct.) 1950.

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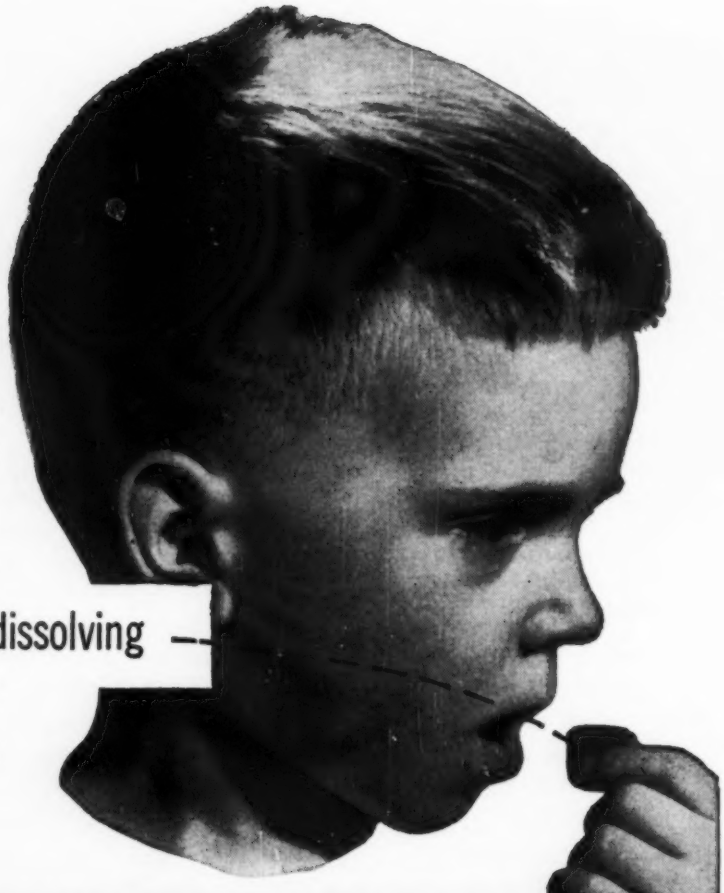

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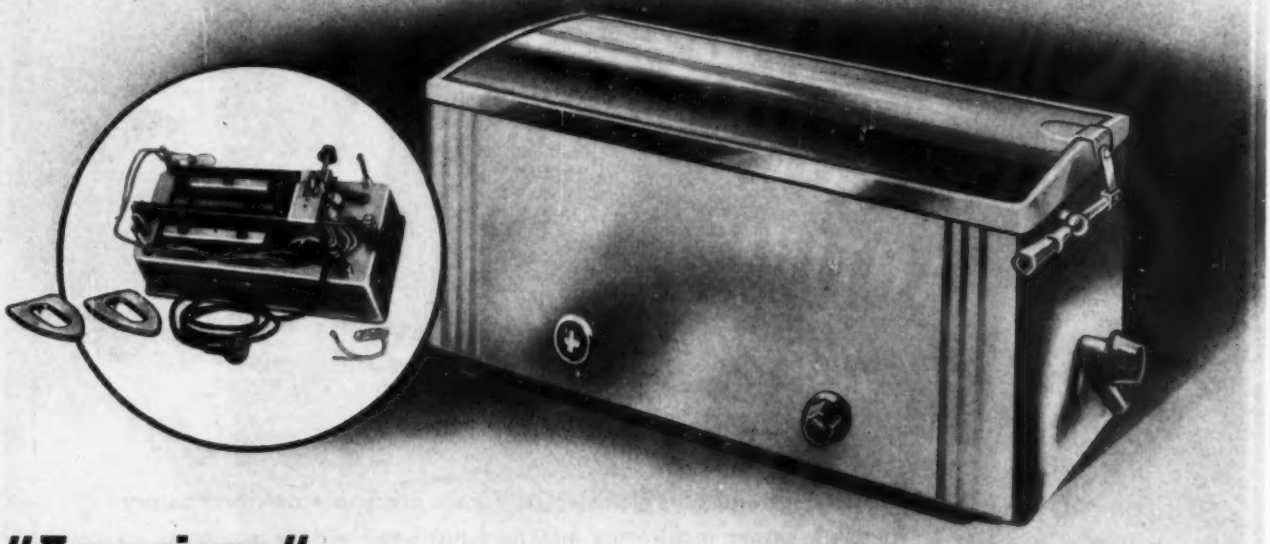

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1. Scudi, J. V., and Reinhard, J. F.: J. Lab. & Clin. Med. 33: 1304 (1948). 2. Carroll, G., and Allen, N. H.: J. Urol. 55: 674 (1946). 3. Simons, I.: J. Urol. 62: 595 (1949). 4. Butt, A. J.: J. Florida M. A. 35: 430 (1949). 5. Merricks, J. W.: West Virginia M. J.: 44: 157 (1948).

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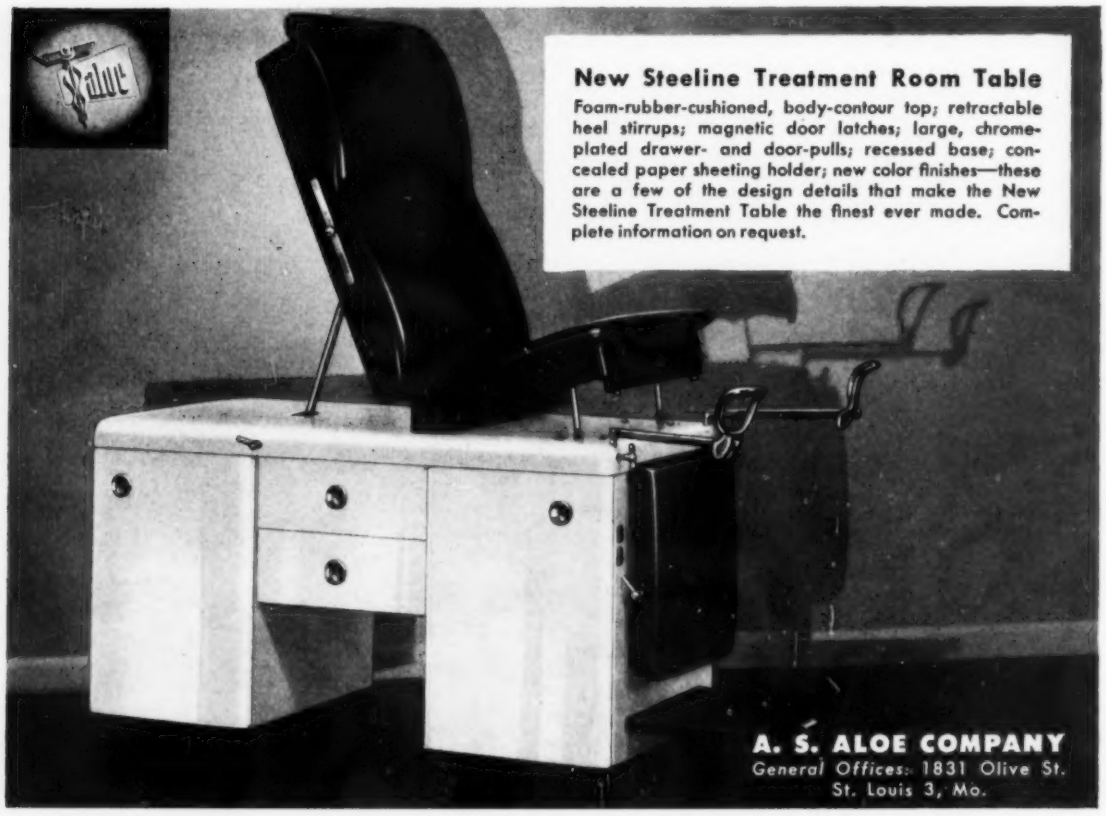
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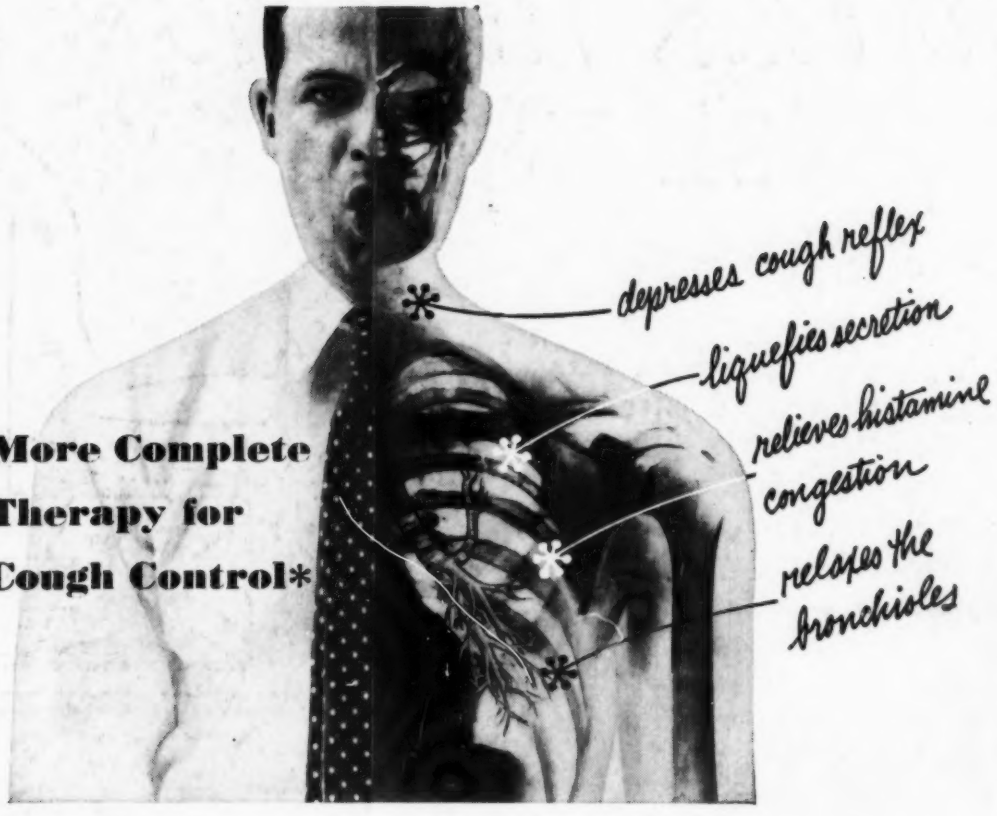

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